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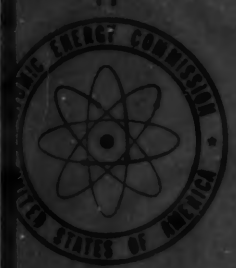

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NUCLEAR SCIENCE ABSTRACTS

Volume 9 July 15, 1955 No. 13

BIOLOGY AND MEDICINE

4344 UCLA-333

California. Univ., Los Angeles. Atomic Energy Project. THE TECHNICS OF LEUKOCYTE ISOLATION. William A. Skoog and William S. Beck. Apr. 12, 1955. 47p. Contract AT-04-1-GEN-12.

AEROSOLS

4345 AD-38787

Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.

AN INVESTIGATION OF FACTORS DETERMINING AGGREGATION OF FINE-PARTICLE MATTER. FINAL REPORT. Clyde Orr, Jr., Mendel T. Gordon, and Jane B. Garrett. June 14, 1954. 134p. Contract DA-18-064-2379.

Results are reported from an investigation of the physical behavior of aerosols and methods of producing highly dispersed and slowly aggregating bacterial aerosols. Aerosols prepared by atomizing a culture of Serratia marcescens and latex and kaolin clay powders were employed. Various types of atomizers and other dispersing devices were studied. Dispersing agents which might reduce clumping in the parent material from which the aerosols were prepared were subjected to many tests. The electric-charge distributions of many aerosols were measured and correlated with the conditions under which the charges were developed. The effects of atmospheric conditions such as temperature, light irradiation, humidity, charge distribution, and other factors on clumping were investigated. Mathematical indexes were derived for expressing the degree of clumping for aerosols. (cf. AD-38787.) (C.H.)

RADIATION EFFECTS

4346 AEC-tr-2121

IRRADIATION INJURY BY IONIZING RADIATIONS. Hermann Muth. Translated from Strahlentherapie 94, 527-38(1954). 24p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 8-6637.

4347

LATE EFFECTS OF BETA RADIATION OF THE EYE. George R. Merriam, Jr. (Presbyterian Hospital, New York). Arch. Ophthalmol. 53, 708-17(1955) May.

Conservatism in the use of beta radiation in superficial ophthalmic lesions is urged, inasmuch as numerous late effects have been observed. These are telangiectasis of the conjunctiva, keratinization of the conjunctival epithelium, atrophy of the sclera, superficial punctate keratitis, corneal vascularization, corneal scarring, iritis, iris atrophy, and radiation cataract. It is suggested that the current high-dosage schedules be reduced. It is felt that doses of 2000-3000 rep on the surface would be more judicious and that a surface dose of 5000 rep should seldom be exceeded in the treatment of benign lesions. (auth)

4348

THE CONTRIBUTION OF RADIATION GENETICS TO AGRICULTURE. W. Ralph Singleton (Brookhaven National Lab., Upton, N. Y.). Agron. J. 47, 113-17(1955) Mar.

Early studies on genetic effects of radiation on plants are reviewed and recent experiments on radioinduced mutations in corn are described. (C.H.)

4349

RADIATION INACTIVATION OF ENZYMES INSIDE AND OUTSIDE INTACT CELLS. Wilson F. Powell and Ernest Pollard (Yale Univ., New Haven, Conn.). Radiation Research 2, 109-18(1955) Apr.

The enzyme invertase has been bombarded by deuterons and electrons in intact yeast cells. The sensitive cross section and the inactivation volume are the same as for commercial preparations. The cytochrome oxidase and succinic dehydrogenase activity of B. subtilis cells and lysates were measured after deuteron and electron bombardment. No differences between the in vivo and in vitro states were found. The two respiratory enzymes are inactivated with a three ionization requirement, and the sensitive regions correspond to molecular weights of 160,000 and 310,000 for cytochrome oxidase and succinic dehydrogenase, respectively. The thickness of both is found to be 36 A. The length of cytochrome oxidase is 200 A, of succinic dehydrogenase 310 A. The effect of 140,000 r on the respiratory enzymes and of 200,000 r on invertase in the intact cells in aqueous suspension is not measurable. Protection by cellular constituents is therefore considerable. (auth)

4350

BACTERIOPHAGE AS INDICATOR IN RADIATION CHEMISTRY. Tikvah Alper (Hammersmith Hospital, London, England). Radiation Research 2, 119-34(1955) Apr.

Results are reported from studies on the mechanisms of radioinduced inactivation of bacteriophage. The role of hydrogen peroxide formation and of oxygen on the response to radiation is discussed. It is suggested that bacteriophage may be used as a radiation chemical indicator. (C.H.)

4351

HEMATOLOGIC CHANGES IN RATS PROTECTED FROM LETHAL X-RADIATION BY POST-IRRADIATION PARABIOSIS. George Metz, Robert T. Binhammer, Martin Schneider, and John C. Finerty (Univ. of Texas Medical Branch, Galveston). Radiation Research 2, 159-65(1955) Apr.

Peripheral blood of rats was studied at 2-day intervals during the period of parabiotic protection from lethal amounts of x radiation. Rats placed in parabiosis within 3 hours after irradiation showed an early leucopenia similar to unprotected animals, but the leucocyte count quickly returned to normal by the eighth post-irradiation

day. An increased absolute heterophile count was seen in all parabionts which may be of significance in parabiotic protection from the effects of irradiation. (auth)

4352

THE EFFECT OF FRACTIONATED X-RAY DOSAGE ON THE FREQUENCY OF CHROMATID AND CHROMOSOME ABERRATIONS. Karl Sax, Edward D. King, and Henry Luippold (Bussey Institution, Harvard Univ., Jamaica Plain, Mass.). Radiation Research 2, 171-9(1955) Apr.

4353

EFFECTS OF ROENTGEN IRRADIATION ON THE TUMOR BED. I. THE INHIBITING ACTION OF LOCAL PRE-TRANSPLANTATION ROENTGEN IRRADIATION (1500r_a) ON THE GROWTH OF MOUSE MAMMARY CARCINOMA. K. W. Stenstrom, H. Vermund, D. G. Mosser, and J. F. Marvin (Univ. of Minnesota Medical School, Minneapolis). Radiation Research 2, 180-91(1955) Apr.

Pretransplantation irradiation with a dose of 1500 r/air of x rays with a half-value layer of 4.2 mm aluminum delivered locally to one leg 48 hours before the subcutaneous inoculation of a tumor cell suspension inhibits the development and the growth-rate of mouse mammary carcinoma. This finding has been established statistically with a probability of chance occurrence of less than 1 in 1000 in several experiments. Quantitative differences in response have been shown between different tumor lines of the same type of mammary carcinoma. Since the tumor tissue itself has received no irradiation, the inhibition is due to radiation effects on the tumor bed or the normal tissues in which the tumor grows. (auth)

4354

THE EFFECTS OF GAMMA AND ROENTGEN RADIATION ON THE INTACT SPINAL CORD OF THE MONKEY. AN EXPERIMENTAL STUDY. Robert L. McLaurin, Orville T. Bailey, Griffith R. Harsh, III, and Franc D. Ingraham (Harvard Medical School, Boston). Am. J. Roentgenol. Radium Therapy Nuclear Med. 73, 827-35(1955) May.

Thirty-five Macacus rhesus monkeys were subjected to gamma radiation from radioactive tantalum or roentgen radiation of the spinal cord. The effects of these two agents were compared qualitatively and quantitatively in normal nervous tissue. The study was also intended to provide a basis for further study of intensive irradiation in the therapy of nervous system tumors. Results are tabulated. (auth)

4355

RADIATION INJURY OF THE CENTRAL NERVOUS SYSTEM. Kenneth L. Krabbenhoft. Am. J. Roentgenol. Radium Therapy Nuclear Med. 73, 850-2(1955) May.

Recent studies on the effects of radiation on the central nervous system are reviewed. (C.H.)

4356

THE RELATIVE EFFECTIVENESS OF VARIOUS IONIZING RADIATIONS ON CHROMOSOME BREAKAGE IN TRADESCANTIA. J. S. Kirby-Smith, C. W. Sheppard, and Doris L. Craig (Oak Ridge National Lab., Tenn.). Pages 262-4 of Radiobiology Symposium (Proceedings) 1954. Z. M. Bacq and P. Alexander, eds. London, Butterworths Scientific Publications, 1954.

RADIATION HAZARDS AND PROTECTION

4357 AMRL-178

Army Medical Research Lab., Fort Knox, Ky.

FURTHER STUDIES OF THE EFFECT OF PARTIAL SHIELDING BY GRIDS ON SURVIVAL OF X-IRRADIATED ANIMALS. J. G. Kereiakes and T. A. O'Neill. Mar. 4, 1955. 17p.

Studies of the partial shielding by grids of x-irradiated animals were extended to include the effect on survival of various sized animals irradiated through grids with various ratios of open to closed areas. The results indicate that for exposure of rats to equal volume doses of x irradiation through grids of constant hole size but of various ratios of open to closed area, the observed survival is a result of the individual effects of interface area, tissue volume irradiated, and total incident dose. The findings for mice x irradiated through grids of constant open-to-closed area but of various hole sizes further substantiated the local effect mechanism of protection for rats by again showing a relationship between degree of survival and interface area between irradiated and normal tissues. (auth)

4358 NYO-4921

Western Reserve Univ., Cleveland. Atomic Energy Medical Research Project.

STUDIES ON THE NATURE OF THE PROTECTIVE ACTIONS OF β-MERCAPTOETHYLAMINE AND CYSTEINE AGAINST X-RAYS AND A NITROGEN MUSTARD. Paul R. Salerno and Hymer L. Friedell. Apr. 27, 1955. 10p. Contract W-31-109-eng-78.

The quantitative aspects of the protective actions of cysteine and β mercaptoethylamine (Becaptan) against x rays and against methyl bis (β-chlorethyl) amine (HN_2) were investigated. The magnitude of the protection afforded against the nitrogen mustard was found to be directly proportional to the molar dosage or sulfhydryl content of each drug. Maximal tolerated doses of Becaptan protect against approximately $2\frac{1}{2}$ lethal doses of HN_2. Cysteine is less than $\frac{1}{4}$ as toxic as Becaptan and accordingly a large dose of cysteine (1100 mg/kg) may be given that elevates the LD_{50} dose of HN_2 tenfold. Thus, cysteine is more than 4 times as effective as Becaptan against HN_2 toxicity simply because it is less toxic and may be given in doses which produce higher sulfhydryl levels. Against radiation toxicity however, cysteine and Becaptan are each comparably effective and antagonize approximately 50% of the x-ray dose. A small dose of cysteine (210 mg/kg) completely antagonizes an LD_{50} dose of HN_2 but does not afford significant radiation protection in rats. These observations suggest that the protection against x rays and HN_2 is mediated by different mechanisms. The requirement of a threshold dose for radiation protection is in keeping with an indirect mechanism that does not involve an interaction of the toxic products of radiation with sulfhydryl groups. It appears that the protective action against nitrogen mustard is a result of the direct interaction of the free sulfhydryl groups of cysteine or Becaptan with the cyclic ethylene imonium ion of HN_2, but that protection against the biological effects of x rays is mediated indirectly through a reduction of intracellular oxygen tension. (auth)

TOXICOLOGY STUDIES

4359

EPIDEMIOLOGY, CLINICAL CHARACTER, AND TREATMENT OF BERYLLIUM POISONING. PROGRESS REPORT. Harriet L. Hardy (Massachusetts General Hospital, Boston). Arch. Ind. Health 11, 273-9(1955) Apr.

Information to date on the epidemiology, clinical

character, and treatment of Be poisoning is summarized. (C.H.)

4360

A METHOD FOR MEASURING THE RATE OF ELIMINATION OF RADON IN BREATH. A. F. Stehney, W. P. Norris, H. F. Lucas, Jr., and W. H. Johnston (Argonne National Lab., Lemont, Ill.). Am. J. Roentgenol. Radium Therapy Nuclear Med. 73, 774-84(1955) May.

Equipment and procedures are described for measuring the time rate of elimination of radon in exhaled air. The accuracy and sensitivity of the analysis are improved by sampling large volumes of exhaled air from which radon is absorbed on charcoal. Interference with normal breathing is negligible, because subjects breathe through large diameter tubing into a flexible bag from which the sample is drawn through the collection apparatus under a small vacuum. Sampling periods of thirty minutes' duration are common. The radon is measured in a low background proportional counter or in an ionization chamber which is connected to an electrometer. The feasibility of extending radon analyses to normal body burdens of the order of 10^{-10} gram Ra is discussed. (auth)

4361

STUDIES OF THE METABOLISM OF RADIUM IN MAN. William P. Norris, Thomas W. Speckman, and Philip F. Gustafson (Argonne National Lab., Lemont, Ill.). Am J. Roentgenol. Radium Therapy Nuclear Med. 73, 785-802 (1955) May.

The retention of radium was studied in a group of 19 patients who received multiple intravenous injections of radium chloride (10 micrograms radium element per dose) at weekly intervals over periods ranging from two to six months during 1931. Results were available from measurements on Ra retention made on two separate occasions within the first year following administration of the $RaCl_2$, and unopened samples of the $RaCl_2$ used for the injections were obtained for comparative analysis. Measurements were made for radium content in 1951 and again in 1953. Results are presented in tabular form and are compared with the earlier data. (C.H.)

4362

THE MODIFICATION OF BERYLLIUM-INDUCED TISSUE DAMAGE IN MICE BY THERAPY WITH AURINTRICARBOXYLIC ACID. H. Lisco and Marcia R. White (Argonne National Lab., Lemont, Ill.). Brit. J. Exptl. Pathol. 36, 27-34(1955) Feb.

A comparative morphological study has been made of the sequences of tissue damage in experimental beryllium poisoning in mice, with and without therapy with aurintricarboxylic acid (ATA). A single injection of ATA greatly diminished beryllium injury in the liver, spleen and bone-marrow of mice poisoned with a LD_{50}/3 days. These organs were free of any trace of beryllium damage at 3 days and 320 days after injection. The mild kidney damage which is caused when beryllium is given alone was potentiated in mice receiving 4 mg of ATA, although the renal injury was transient and the kidneys were normal after seven days. No potentiation of kidney damage was seen in mice treated with only 2 mg of ATA. (auth)

TRACER APPLICATIONS

4363 UCRL-2924

California. Univ., Berkeley. Radiation Lab.

THE PHOTOSYNTHETIC CYCLE. Melvin Calvin. Mar. 21, 1955. 47p. Contract W-7405-eng-48.

Results are reviewed from C^{14}-tracer studies on the production of carbohydrates during photosynthesis. (C.H.)

4364

ACCURACY OF A RADIOPOTASSIUM DILUTION (STEWARD PRINCIPLE) METHOD FOR THE MEASUREMENT OF CARDIAC OUTPUT. Hadley L. Conn, Jr. (Brookhaven National Lab., Upton, N. Y.). J. Appl. Physiol. 7, 542-8(1955) Mar.

A method for the measurement of cardiac output by the Hamilton-Stewart principle, which employs radiopotassium (K^{42}) as the test substance, is described. Its advantages, particularly that of minimizing the recirculation of indicator, are discussed. (auth)

CHEMISTRY

4365 MLM-979

Mound Lab., Miamisburg, Ohio.

ABSORBANCY STUDIES OF POLONIUM COMPLEXES IN CHLORIDE SOLUTIONS. (INFORMATION REPORT). D. J. Hunt. 26p. Contract AT-33-1-GEN-53.

A study has been made of polonium complexes in hydrochloric acid solutions. Absorption peaks at 344 mμ below 0.5M hydrochloric acid, and at 418 mμ above 0.5M hydrochloric acid were observed. The equilibrium between the two polonium complexes causing these absorptions has been investigated. The absorption peak at 418 mμ may be used as a means of determining polonium concentration in solutions above 1M in hydrochloric acid. (auth)

4366 NP-5621

Pennsylvania State Univ., State College. Cryogenic Lab.

RESEARCH AND DEVELOPMENT ON THERMODYNAMICS OF SIMPLE GASES ADSORBED ON SOLIDS. TESTS OF A SIMPLIFIED GENERAL MODEL FOR ADSORPTION OF RARE GASES ON SOLIDS. TECHNICAL REPORT [FOR] APRIL 1, 1954 TO JANUARY 31, 1955. J. G. Aston, R. J. Tykodi, and W. A. Steele. Mar. 30, 1955. 21p. Contracts N6-ONR-269, T. O. 10 and DA-36-061-ORD-403.

Adsorption isotherms have been measured for He, A, and Ne on titanium dioxide and heats of adsorption have been calculated. Attempts were made to correlate the data obtained in terms of a simple site distribution function. (C.W.H.)

4367 NRL-Memo-454

Naval Research Lab., Washington, D. C.

THERMAL AND RELATED PHYSICAL PROPERTIES OF MOLTEN MATERIALS. PROGRESS REPORT NO. 12 [FOR] NOVEMBER 1, 1954-JANUARY 31, 1955. B. E. Walker, C. T. Ewing, and D. D. Williams. Apr. 1, 1955. 9p.

Heat content and heat capacity measurements on salt "C" in the temperature range 30 to 900°C are reported. (C.W.H.)

4368 NYO-7125

Harvard Univ., Cambridge, Mass.

CYCLOPENTADIENYL-TRIETHYLPHOSPHINE-COPPER(I). G. Wilkinson and T. S. Piper. Apr. 15, 1955. 15p. Contract AT(30-1)-1461.

The syntheses of $C_5H_5CuP(C_2H_5)_3$ and $(C_2H_5)_2Hg$ are reported. Chemical properties and ultraviolet and infrared spectra of these compounds are described. (C.W.H.)

4369 TT-516

ON THE ELECTRICAL CONDUCTIVITY OF ZINC OXIDE WITH THE ADDITION OF FOREIGN OXIDES. (Über Die Elektrische Leitfähigkeit Von Zinkoxyd Mit Fremdoxydzusätzen). Karl Hauffe and A. L. Vierk. Translated by D. A. Sinclair from Z. physik. Chem. 196, 160-80(1950). 29p.

4370

SIMULTANEOUS SURFACE EXCHANGE STUDIES USING BOTH CATION AND ANION. R. M. Stow and J. W. T. Spinks (Univ. of Saskatchewan, Saskatoon, Canada). Can. J. Chem. 33, 938-46(1955) May.

Labelled Sr^{2+} and SO_4^{2-} have been used simultaneously to measure the apparent surface area of a $SrSO_4$ precipitate by the direct radioactive method. The values found differ by about 90%. By contrast, when labelled Pb^{2+} and SO_4^{2-} are used to measure the apparent surface area of $PbSO_4$, the values found are in close agreement. The results are discussed with reference to the kinetics of surface exchange reactions. (auth)

4371

KINETICS OF COMPETITIVE PROCESSES WHEN REACTIVE FRAGMENTS ARE PRODUCED IN PAIRS. Richard M. Noyes (Columbia Univ., New York). J. Am. Chem. Soc. 77, 2042-5(1955) Apr. 20.

If a molecule is dissociated into two radicals in liquid phase, the radicals may undergo primary recombination in the "cage" in which they are formed, may undergo diffusive secondary recombination, or may combine with radicals from other dissociations. A scavenger that can react with radicals may compete with the combination process even at low concentrations, and conventional kinetic expressions are developed to describe the competition. These expressions depend on whether the product of reaction with scavenger is a reactive radical itself or is inert. Only a very reactive scavenger can compete with the secondary recombination of original partners from a dissociation. If such competition does occur, the amount of additional reaction varies approximately as the square root of the concentration of scavenger. Primary recombination occurs too rapidly for competition except in a medium that consists almost entirely of very reactive scavenger. The term "geminate recombination" is proposed for the total of primary and secondary recombination of original partners; this total is usually lumped together in references to "cage" effects. (auth)

4372

THE DIFFUSION COEFFICIENTS OF LITHIUM AND POTASSIUM PERCHLORATES IN DILUTE AQUEOUS SOLUTIONS AT 25°. Herbert S. Harned, Herman W. Parker, and Milton Blander (Yale Univ., New Haven, Conn.). J. Am. Chem. Soc. 77, 2071-3(1955) Apr. 20.

The differential diffusion coefficients of lithium and potassium perchlorates have been determined at 25° by the conductometric method at concentrations between 0.001 and 0.01 molar. Theoretical considerations indicate that at low concentrations the activity coefficients of these electrolytes are nearly identical. This result differs from previous conclusions derived from freezing point data. (auth)

4373

ISOTOPIC EXCHANGE REACTIONS OF PHOSPHORUS PENTACHLORIDE. James J. Downs and Rowland E. Johnson (Florida State Univ., Tallahassee). J. Am. Chem. Soc. 77, 2098-2102(1955) Apr. 20.

The rate of exchange between phosphorus pentachloride and labeled chlorine in solvent carbon tetrachloride shows a difference in reactivity for the various chlorine atoms in the pentachloride molecule, three chlorine atoms reacting rapidly and two slowly. Chlorine, on addition to phosphorus trichloride, enters mainly into the equatorial positions; mercury attacking phosphorus pentachloride removes chlorine mainly from the equatorial positions. Mechanisms are proposed and an explanation for the difference in reactivities is suggested. In addition, the isotopic exchange reactions in carbon tetrachloride between chlorine and phosphorus oxychloride and between phosphorus trichloride-Cl^{36} and phosphorus pentachloride have been found to be measurably slow. (auth)

4374

LOW-TEMPERATURE HEAT CAPACITIES AND ENTROPIES AT 298.16°K OF SOME TITANATES OF ALUMINUM, CALCIUM, LITHIUM AND ZINC. E. G. King (Bureau of Mines, Berkeley, Calif.). J. Am. Chem. Soc. 77, 2150-2 (1955) Apr. 20.

Heat capacity measurements in the temperature range 51 to 298°K. were conducted for aluminum titanate, tricalcium dititanate, lithium metatitanate and zinc-titanium spinel. Regular behavior was observed for all four substances. The following entropy values (cal./deg. mole) at 298.16°K. were obtained: 26.2 ± 0.2 for aluminum titanate; 56.1 ± 0.4 for tricalcium dititanate; and 21.9 ± 0.1 for lithium metatitanate. The measurements and ordinary extrapolation for zinc-titanium spinel yield $S^\circ_{298.16} = 32.8 \pm 0.2$ cal./deg. mole. This value should be increased by an at present unknown amount to take account of randomness in the crystal structure. (auth)

4375

HIGH TEMPERATURE HEAT CONTENTS OF SOME TITANATES OF ALUMINUM, IRON AND ZINC. K. R. Bonnickson (Bureau of Mines, Berkeley, Calif.). J. Am. Chem. Soc. 77, 2152-4(1955) Apr. 20.

Measurements of heat contents above 298°K. were conducted for aluminum titanate, ferric titanate, titanomagnetite and zinc-titanium spinel to temperatures of 1803, 1739, 1513 and 1798°K., respectively. Normal behavior was observed, except for titanomagnetite which shows an unusual upward trend in heat content beginning about 1200°K. A table of smooth matching values of heat content and entropy increments was constructed and heat content equations were derived. (auth)

4376

ARSINE. VAPOR PRESSURE, HEAT CAPACITY, HEATS OF TRANSITION, FUSION AND VAPORIZATION. THE ENTROPY FROM CALORIMETRIC AND FROM MOLECULAR DATA R. H. Sherman and W. F. Giauque (Univ. of California, Berkeley). J. Am. Chem. Soc. 77, 2154-60(1955) Apr. 20.

4377

OXIDATION OF OXYGEN-SATURATED TITANIUM. M. Simnad, Aija Spilners, and O. Katz (Carnegie Inst. of Tech., Pittsburgh). J. Metals 7, 645-6(1955) May.

Oxidation rates of oxygen-saturated and oxygen-free Ti between 800 and 1200°C were measured, and appreciable differences in their rates of oxygen uptake and activation energies were observed. Reasons for these differences are discussed. (L.M.T.)

ANALYTICAL PROCEDURES

4378 CCC-1024-TR-99

Oklahoma. Univ., Norman.

DEVELOPMENT OF INSTRUMENTAL METHODS FOR THE DETERMINATION OF BORON. P. L. Pickard, J. R. Kenton, and W. E. Naptune. Mar. 3, 1955. 92p. [For Callery Chemical Co. Contract Noa(s)-52-1024-c].

The published methods of analysis for boric acid were studied with the aim of determining maximum and minimum concentrations for which a given method is most effective. Using the conductometric method of analysis, sample sizes from 10 mg to 0.5 g were determined. Higher amounts of boric acid could have been determined, but it was considered unnecessary to have a sample weight large enough to contain more than this amount of boric acid. This range of sample weights corresponds to 67 μg per ml through 3300 micrograms of boric acid per ml of solution. The colorimetric procedure without starch has a range below 5 μg per ml to 100 μg of boric acid per ml of solution. If starch is added to the reagents, the range of the modified procedure extends from zero concentration to 5 μg of boric acid per ml of solution. The polarimetric method range when using tartaric acid extends from 0.02 mg. to at least 2 mg. of boric acid per ml of solution but this is as high a concentration as was tried. This is a very wide concentration range, but under the conditions of the method used, the results were ±0.5 mg. boric acid minimum error in a 25 ml. sample. The potentiometric method gave results in the same range as the conductometric method and with approximately the same degree of accuracy. A study was made of boric acid–diol solutions polarographically. In aqueous solution it was found that the halfwave potential of boric acid–mannitol shifts with concentration of boric acid. The diffusion current varies linearly with concentration however and, with a given concentration of mannitol, may be used for analysis of boric acid solutions. The polarographic wave measured was ascribed to hydrogen ion reduction from dissociation of the diol–boric acid complex. A study of sodium peroxyborate yielded kinetic decomposition rates of this compound. It was also shown that the compound contains hydrogen peroxide of crystallization rather than decomposing in water to yield this peroxide. Polarography of the amine–boron trifluoride compounds shows halfwave potentials in the range of −1.54 to +1.57v vs. saturated calomel electrode. Maximum wave height was obtained in the presence of 0.01M boric acid and 0.01% gelatin was found to suppress the usual maximum. The effect was ascribed to catalytic hydrogen deposition, the catalytic activity of the hydrolysis product of the complex varying with the amine. For any given amine–boron trifluoride complex, a polarographic analysis can be developed. However, a period of reflux is necessary on each solution to produce linearity of wave height with concentration. (auth)

4379 CCC-1024-TR-102

Northwestern Univ., Evanston, Ill.

STUDY OF CHELATING AGENTS FOR THE DETERMINATION OF BORIC ACID IN AQUEOUS SOLUTIONS. D. D. DeFord and C. A. Lucchesi. Mar. 18, 1955. 77p. [For Callery Chemical Co. Contract Noa(s)-52-1024-c].

A gravimetric method for the determination of boric acid in aqueous solutions based on the precipitation of tetrafluoboric acid with nitron has been developed. Triethanolamine, salicylic acid, and fluoride ion were also studied as possible reagents in a boric acid determination. (C.W.H.)

4380 MCC-1023-TR-117

Johns Hopkins Univ., Baltimore.

BORON ANALYSIS BY NEUTRON ABSORPTION. FINAL REPORT. R. P. Hamlen and W. S. Koski. Feb. 1955. 24p. [For Olin Mathieson Chemical Corp. Contract N NOa(s)-52-1023-c].

Investigation was made to determine the feasibility of rapid boron analysis by utilizing the high affinity of B^{10} for neutrons. If a boron containing material is irradiated with slow neutrons, the nuclear reaction $B^{10}(n,\alpha)Li^{7}$ is realized. The number of such reactions is a measure of the B^{10} content and if the isotopic abundance is constant it is also a measure of total boron content. This reaction was detected either by the presence of the emitted alpha particle or the 120 kev gamma ray which is associated with a definite fraction of these reactions. Also, the attenuation of the neutrons as they passed through boron containing solution was used as a measure of the intensity of this reaction. Attempts were made to detect the alphas from this reaction by scintillations in appropriate paraxylene-terphenyl solutions. The attempt was not a success because boron hydrides such as decaborane quenched the fluorescence. Attempts to detect these alpha particles with gaseous boron hydrides utilizing a silver activated zinc sulfide phosphor were more successful. Successful application of this method was made in B^{10} isotopic analysis. Attempts to utilize gamma ray detection as a measure of total boron content were unsuccessful because of the high background from the PO–Be neutron source. Measurements of the attenuation of the neutron flux as it passed through boron containing solutions were the most successful approach as far as total boron analysis is concerned. In solutions containing 0.1% boron, the total boron content could be determined to within 3%. Higher accuracy can be expected for higher boron contents. This method could be adapted to rapid analysis of relatively large amounts of solutions or gases containing boron. It could also be applied to continual monitoring of a flow system. (auth)

4381 NBL-106

New Brunswick Lab., AEC., N. J.

THE SEPARATION AND DETERMINATION OF SCANDIUM. SPECTROPHOTOMETRIC METHOD USING ALIZARIN RED S. A. R. Eberle and M. W. Lerner. Apr. 1955. 24p.

A colorimetric method for the determination of scandium has been developed. The scandium alizarin sulfonate lake is used as the color complex in an ammonium acetate buffer medium. The color reaction conforms to Beer's Law in the concentration range of 10 to 120 γ of scandium oxide per 100 ml. Scandium is isolated stepwise from all interferences by (1) a cupferron-chloroform extraction; (2) an iodate precipitation in nitric acid; (3) a tributyl phosphate extraction in a hydrochloric acid system; (4) an ammonium tartrate precipitation; (5) a tributyl phosphate extraction in a hydrochloric acid system. Extraction data for scandium in hydrochloric acid–tributyl phosphate systems is presented. Results are reported on the recovery of scandium in the presence of the major metal ions and of the analyses of some waste residues, process liquors, and minerals. (auth)

4382 NRL-4528

Naval Research Lab., Washington, D. C.

THE APPLICATION OF X-RAY FLUORESCENCE TO

TRACE ANALYSIS. Martin B. Cavanagh. [Apr. 1, 1955]. 5p.

The elements hafnium, niobium, tantalum, thorium, and uranium, have been determined in micro quantities in iron by the application of x-ray fluorescence techniques. The iron and other impurities are removed by means of electrodeposition in mercury, and the residual elements are concentrated on a mylar film for x-ray examination. Five micrograms of these elements can be determined in the presence of each other to within 10% of the amount present. (auth)

4383 PDB-150

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

MICRODETERMINATION OF SULPHUR FOR THE ESTIMATION OF SULPHATE OR SULPHITE. G. M. Allison. Dec. 28, 1954. 11p.

Sulphate or sulphite compounds are reduced to hydrogen sulphide with a special reducing mixture. The evolved H_2S is absorbed in a zinc acetate solution and methylene blue is developed on the addition of aminodimethylaniline reagent and ferric ammonium sulphate solution. The intensity of the methylene blue is proportional to the sulphur compound in the sample. Satisfactory results have been obtained on sulphate solutions. However, investigation into removal of nitrate interference was not completed and more development work on this phase of the method is required. (auth)

4384 SP(CS)-METH-9A

Gt. Britain. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF URANIUM IN PURE AMMONIUM DIURANATE. Oct. 18, 1954. 2p.

4385 SP(CS)-METH-171

Gt. Brit. Springfields [Works], Springfields, Lancs, England.

THE DETERMINATION OF CHLORIDE IN URANIUM TETRAFLUORIDE. Oct. 26, 1954. 4p.

The fluoride is complexed with aluminum nitrate and the chloride separated by distillation and subsequently determined turbidimetrically using silver nitrate. The method is found suitable for the determination of 0 to 10 ppm chloride. (auth)

4386 UCRL-4148

California. Univ., Livermore. Radiation Lab.

THE ANALYSIS OF HYDROGEN–DEUTERIUM MIXTURES USING THE CONSOLIDATED ENGINEERING CORPORATION MODEL 21–103 SPECTROMETER. A. S. Newton and Bobby Ann Mohler. July 10, 1953. Changed from OFFICIAL USE ONLY Apr. 28, 1955. 10p. Contract W-7405-eng-48.

The analysis of mixtures of hydrogen and deuterium in terms of H_2, HD, D_2 using a Consolidated Engineering Corporation Model 21-103 spectrometer, is described. All corrections due to differing sensitivities and leak rates are eliminated in the method used. The method is good in the isotopic composition range 0.1% to 99.9% D. (auth)

4387

CONCENTRATION OF Ra IN Ra-Ba MIXTURES. O. Gübeli and H. Jucker. Helv. Phys. Acta 38, 492-9(1955) Mar. (In German)

4388

RADIOCHEMICAL METHOD FOR THE DETERMINATION OF U^{235} CONTENT IN URANIUM. I. G. de Fraenz and W. Seelmann-Eggebert. Publs. com. nacl. energia atomica (Buenos Aires), Ser. quim. 1, No. 1, 1-9(1954). (In Spanish)

A fast radiochemical method is given which permits the determination of the isotopic relation between U^{235} and U^{238}. The method is based on two special separations of Th^{231} and Th^{234} from uranium, so that the relation between the activities of these thorium isotopes can be easily measured. The isotopic relation to be determined is calculated from the relation of activities of the daughter substances. By means of a series of experiments, it is shown with what accuracy the analysis can be carried out in practice. (auth)

4389

DETERMINATION OF SMALL QUANTITIES OF THORIUM BY RADIOACTIVATION. E. N. Jenkins (Atomic Energy Research Establishment, Harwell, Berks, England). Analyst 80, 301-13(1955) Apr.

Pile irradiation of samples containing Th^{232} produces the 22-minute beta-active Th^{233}. A subsequent chemical attack on the sample and an addition of natural thorium carrier may be followed by a double precipitation as the oxalate, conversion to the nitrate, chromatographic purification on an aluminium oxide–cellulose column, and a final precipitation for weighing and counting as a hydrated thorium oxalate containing the 233 isotope in a high state of radiochemical purity. The method has been successfully applied to the determination of microgram and submicrogram amounts of thorium in the presence of a large excess of potentially interfering elements. The half life of Th^{233} has been redetermined as 22.12 ± 0.05 minutes. (auth)

4390

DETECTION OF BERYLLIUM BY MEANS OF THE Be^9 $(\alpha,n\gamma)C^{12}$ REACTION. Erik Odeblad and Giuseppe Nati (Karolinska Institutet, Stockholm). Acta Radiol. 43, 249-55(1955) Mar.

The gamma rays of 4.4 Mev arising when beryllium is bombarded with alpha particles were used for the detection of beryllium in various known concentrations in blood plasma, red blood cells, and other tissues. The presence of boron, aluminum, magnesium and other elements disturb the reaction. Various other factors influencing the analysis of beryllium in this way are discussed. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

4391

RADIOGRAPHIC DETERMINATION OF ELECTRON DISTRIBUTION IN CRYSTALS. ELECTRON DISTRIBUTION IN LITHIUM FLUORIDE. J. Krug, H. Witte, and E. Wölfel. Z. physik. Chem. (Frankfurt) [N. F.] 4, 36-64(1955) May. (In German)

4392

STUDIES OF ABSORPTION SPECTRA. VII. SYSTEMS WITH THREE AND MORE f-ELECTRONS. Chr. Klixbüll Jørgensen. Kgl. Danske Videnskab. Selakab, Mat.-fys. Medd. 29, No. 11, 1-29(1955). (In English)

The atomic energy levels causing the narrow bands of lanthanide and actinide elements are investigated. The case of Nd^{+++}, studied by Satten, is discussed with particular respect to the doublet terms, and the other systems with

three effective f-electrons are considered. The electrostatic interaction of 4, 5, 6, and 7 f-electrons is computed from Racah's and simpler cases from Condon and Shortley's theory. The relative positions of the multiplets agree well with the observed spectra, while the certain identification of the different levels is difficult, due to effects of intermediate coupling. In most of the actinide ions, the Lande interval factor ζ_{5f} is found to be rather more than 2 ζ_{4f} in the corresponding lanthanide ions. The electrostatic interaction, which separates the terms, seems to be quite similar in the two cases, except for an increase with increasing oxidation state, due to variations in effective charge. The transitions [Em] 5 $f^n \rightarrow$ [Em] 5 f^{n-1} 6 d, causing broad and intense absorption bands, are used to estimate the very high energy difference between 6 d- and 5 f-electrons in the actinide ions. Some spectra due to molecular transfer of electrons are discussed and the spectrum of Cm^{+++} is shown not to be the predicted f^7-spectrum. Observed spectra of Dy^{+++} and Er^{+++} are compared with the theory. Several tables give numerical results, of electrostatic interaction in the investigated cases of lanthanide and actinide ions. (auth)

4393

STUDIES OF ABSORPTION SPECTRA. X. d-ELECTRONS IN CRYSTAL FIELDS OF DIFFERENT SYMMETRIES. C. J. Ballhausen and Chr. Klixbüll Jørgensen. Kgl. Danske Videnskab., Mat.-fys. Medd. 29, No. 14, 1-32(1955). (In English)

The group-theoretical derivation of the possible states in crystal fields of cubic, tetragonal, and rhombic symmetry is presented as operations with simple five-dimensional vectors. The problem of interaction between two states alone by going from weak to strong crystal fields is solved. The behaviour of one d-electron in the fields of different symmetry is discussed. (auth)

DEUTERIUM AND DEUTERIUM COMPOUNDS

4394

HYDROGEN PEROXIDE AND ITS ANALOGUES. VII. CALORIMETRIC PROPERTIES OF THE SYSTEMS $H_2O-H_2O_2$ AND $D_2O-D_2O_2$. Paul A. Giguere, B. G. Morissette, A. W. Olmos, and O. Knop (Laval Univ., Quebec, Canada). Can. J. Chem. 33, 804-20(1955) May.

The heat capacity and heats of mixing, vaporization, and decomposition of $H_2O-H_2O_2$ system were measured at 0° and 27°C. Similar measurements were made on the $D_2O-D_2O_2$ system. The thermochemical properties of the pure peroxides in the liquid state at 25°C were derived. (C.W.H.)

FLUORINE AND FLUORINE COMPOUNDS

4395 CAP-TM-4

Gt. Brit. Capenhurst Works, Capenhurst, Ches., England.
THE HALOGEN FLUORIDES—A NEW GROUP OF CHEMICAL REAGENTS. (Notes on a Lecture given by H. R. Leech, Oct. 16, 1953). T. J. Brown and R. A. Mascall, comps. 4p.

Preparation, properties, and uses are briefly discussed. (L.M.T.)

4396 K-1213

Carbide and Carbon Chemicals Co. K-25 Plant, Oak Ridge, Tenn.
THE CURRENT EFFICIENCY OF MEDIUM TEMPERATURE FLUORINE CELLS. S. Katz, G. H. Montillon, T. Lee, J. J. Finley, and M. R. Hertz. May 11, 1955. 14p. Contract W-7405-eng-26.

Fluorine cell efficiencies have been calculated from measurement of electrolytic current and hydrogen production. The cell efficiency was determined for the range of amperage, hydrogen fluoride concentrations, and temperatures normally used in cell operations and for a cell with a structural modification. (auth)

4397

MULTIPLE CELL FLUORINE PLANT. DESIGN AND OPERATION. J. Jacobson, W. K. Henderson, T. P. Fleming, R. W. Levin, and J. A. Marshall (Carbide and Carbon Chemicals Co., Oak Ridge, Tenn, and Paducah, Ky.). Ind. Eng. Chem. 47, 878-83(1955) May.

The design and operation of a 36-cell fluorine plant with a 2-ton per day capacity are described. (C.W.H.)

4398

IMPROVED MEDIUM TEMPERATURE FLUORINE CELL. J. Dykstra, S. Katz, C. B. Clifford, E. W. Powell, and G. H. Montillon (Carbide and Carbon Chemicals Co., Oak Ridge, Tenn. and Paducah, Ky.). Ind. Eng. Chem. 47, 883-7(1955) May.

The construction details and operating characteristics for an improved fluorine cell are given. This cell operates at 100° to 105°C using a fused salt bath of KF-2HF. These cells are the basic unit of the fluorine plant described in (Ind. Eng. Chem. 47, 883-7(1955)) May. (C.W.H.)

GRAPHITE

4399

THE ADSORPTION OF NITROGEN, OXYGEN, AND ARGON BY GRAPHITE. H. L. McDermot and J. C. Arnell (Defence Research Chemical Labs., Ottawa, Canada). Can. J. Chem. 33, 913-22(1955) May.

The adsorption of nitrogen, oxygen, and argon by three Acheson graphites has been measured at liquid nitrogen and liquid oxygen temperatures. The isotherms were Type II in the B.E.T. classification and displayed two kinds of hysteresis. The first kind was attributed to the presence of pores in the graphite and the second kind to intercrystalline swelling. (auth)

LABORATORIES AND EQUIPMENT

4400

USING NEUTRONS FOR REMOTE LIQUID-LEVEL GAGING. S. Barnartt and K. H. Sun (Westinghouse Research Labs., East Pittsburgh, Penna.). Nucleonics 13, No. 5, 47-9(1955) May.

A method is described by which the level of a hydrogenous liquid in a tank can be measured remotely to ± 2 mm or better from outside the container by means of a fast-neutron source attached to a slow-neutron counter. The source may be positioned below but not too close to the counter, or above the counter but not too far away from it. Equal precision is attainable when the source is stationary and either opposite the liquid outside the tank or inside the liquid. (C.H.)

4401

SMALL DRY BOX FOR PHOSPHORS. Wayne A. Cassatt, Jr. and W. Wayne Meinke (Univ. of Michigan, Ann Arbor). Nucleonics 13, No. 5, 63-4(1955) May.

A dry box is described which provides sufficient room

for polishing and mounting crystals and which attains a dry atmosphere by overnight exposure to a dessicant. (C.H.)

RADIATION CHEMISTRY

4402

THE EFFECT OF IONIZING RADIATION ON AMINO ACIDS. II. THE EFFECT OF X-RAYS ON AQUEOUS SOLUTIONS OF ALANINE. Norman E. Sharpless, Alberta E. Blair, and Charles R. Maxwell (National Inst. of Arthritis and Metabolic Diseases, Bethesda, Md.). Radiation Research 2, 135-44(1955) Apr.

The action of x radiation on aqueous solutions of α-alanine was investigated with and without oxygen. Products of irradiation in the absence of oxygen include ammonia, acetaldehyde, hydrogen, pyruvic acid, propionic acid, carbon dioxide, ethylamine, carbon monoxide, and methane. In the presence of oxygen and with large radiation doses acetic and formic acids were also formed. The radiation decomposition of alanine was found to parallel to a remarkable degree that of glycine and similarities between the radioinduced reactions of the two amino acids are discussed. (C.H.)

4403

STUDIES ON THE MECHANISM OF ACTION OF IONIZING RADIATIONS. XIII. THE EFFECT OF X-IRRADIATION ON SOME PHYSICO-CHEMICAL PROPERTIES OF AMINO ACIDS AND PROTEINS. E. S. Guzman Barron, John Ambrose, and Phyllis Johnson (Univ. of Chicago, Ill.). Radiation Research 2, 145-58(1955) Apr.

Dilute aqueous solutions of aromatic amino acids showed marked changes in their absorption spectra after x irradiation with moderate doses of x rays, irradiation of tyrosine increasing light absorption around 2800 A, and irradiation of tryptophan decreasing it. Similar changes were observed on irradiation of proteins: those with a tyrosine/tryptophan ratio greater than 1 showed an increase in light absorption, whereas those with a ratio less than 1 showed a decrease. Inhibition of enzyme activity of lysozyme seemed to be related to decrease of light absorption in the far ultraviolet, about 2400 A. The initial reaction on x irradiation of amino acids seems to be an oxidative deamination: on x irradiation of glycine there was equimolar formation of glyoxylic acid and NH_3. On x irradiation of serum albumin with x ray doses not high enough to produce denaturation there was a decrease in the combining power with anionic dyes and an increase in the combining power with Cu^{++} ions. These effects are explained as the consequence of the loss of NH_2 groups in the protein. (auth)

4404

CARBON COMPOUNDS PRODUCED BY PILE NEUTRON IRRADIATION OF CRYSTALLINE AMMONIUM SULFATE: TARGET DISSOLVED IN WATER. Peter E. Yankwich and W. R. Corman, Jr. (Univ. of Illinois, Urbana). J. Am. Chem. Soc. 77, 2096-8(1955) Apr. 20.

The radiocarbon activities produced when pile neutron-irradiated ammonium sulfate crystals are dissolved in water or 1 M sodium hydroxide have been subjected to chemical fractionation. Carbon dioxide is formed in greatest amount (40% of the total activity); other radio compounds formed are methylamine (16%), formic acid (16%), formaldehyde (13%), urea (7%), cyanide (6%), and carbon monoxide, methanol and methane (each less than 3%). Comparison of these yields with those obtained from irradiated ammonium bromide demonstrates clearly the role of oxygen in the crystals as a scavenger for highly reduced combinations including the nascent carbon, but does not permit a clear decision in any particular case as to whether or not the radio compound is formed as such in the sulfate crystals. (auth)

RADIATION EFFECTS

4405

THE DECAY OF LUMINESCENCE OF Ag ACTIVATED Zn Sulfide PHOSPHORS AFTER EXCITATION BY SINGLE ALPHA PARTICLES AND ELECTRONS. Dieter Smidt. Ann. Physik 15, 325-36(1955) Mar. (In German)

RARE EARTHS AND RARE-EARTH COMPOUNDS

4406

OPTICAL STUDIES OF CEROUS SOLUTIONS. Lawrence J. Heidt and Jane Berestecki (Massachusetts Inst. of Tech., Cambridge). J. Am. Chem. Soc. 77, 2049-54(1955) Apr. 20.

A study of the near ultraviolet absorption spectra of aqueous solutions of cerous perchlorate together with perchloric acid and sodium perchlorate has revealed evidence for the existence of a $CeClO_4^{+2}$ complex, for two new absorbance peaks located at about 2010 and 2110 A. and for an isosbestic point located at about 2790 A. The difference between the extinction coefficients of the two cerous species is greatest percentagewise at the peak located at 2960 A. where the complex appears to absorb about one third as much light as the uncomplexed cerous ion. The values of the thermodynamic constants of the reaction $Ce^{+3} + ClO_4^- = CeClO_4^{+2}$ at 25° are $\Delta F^\circ = -2.6$ kcal., $\Delta H^0 = -11.8$ kcal., and $\Delta S^0 = -31$ e.u. The absorption spectra, of the solutions consist of three groups of peaks whose strongest peaks are separated by 5700 $cm.^{-1}$ and are located at 2215, 2530 and 2960 A. The peaks in each group are separated by about 2300 $cm.^{-1}$; the two new peaks are satellites of the peak at 2215 A. The highest peak is at 2530 A. and has one satellite which is located at 2390 A. and is the next highest peak. The 2960 A. peak is the lowest of all and has no satellite. Evidence also has been obtained for the existence of a cerous sulfamate complex, $CeSO_3NH_2^{+2}$, whose formation constant is about one-fifth of the value of the perchlorate complex. (auth)

4407

THE SEPARATION OF EUROPIUM FROM SAMARIUM BY ELECTROLYSIS. E. I. Onstott (Los Alamos Scientific Lab., N. Mex.). J. Am. Chem. Soc. 77, 2129-32(1955) Apr. 20.

Europium is efficiently separated from samarium by electrolysis of the europium citrate complex ion at a lithium amalgam cathode. Samarium oxide containing 1.6% europium oxide is quantitatively freed of the europium with one electrolysis. Under optimum conditions, 99.9% of the europium is removed into the mercury phase, while less than 10% of the samarium is removed. Parameters affecting the electrolysis are discussed. (auth)

4408

FORMATION OF $Ce_2O_3 \cdot 2ZrO_2$ IN THE SYSTEM $BaCl_2$–$CeCl_3$–$BaZrO_3$. J. J. Casey, Lewis Katz, and William C. Orr (Univ. of Connecticut, Storrs). J. Am. Chem. Soc. 77, 2187-9(1955) Apr. 20.

Ion distributions in solid-melt systems at high temperatures (about 1000°) in which the system principally studied was $BaCl_2$–$CeCl_3$–$BaZrO_3$ is reported. Radiotracer experiments in which cerium ranged in concentration from

10^{-12} to 18.7 atom % of the cerium-zirconium content showed that essentially none of the cerium remained in the molten phase. At low cerium content (Ce:Zr atom ratio = 0.01 to 0.053) some of the barium ions in barium zirconium oxide are replaced by cerium(III) ions. As the cerium content of the system is increased the principal reaction becomes one resulting in the formation of the phase $Ce_2O_3 \cdot 2ZrO_2$. This is rapidly oxidized in air at elevated temperatures to $CeO_2 \cdot ZrO_2$. (auth)

SEPARATION PROCEDURES

4409

THE SEPARATION OF RARE EARTHS WITH THE AID OF ACETIC ACID (ETHYLENEDIAMINE)TETRA-. G. Brunisholz. Helv. Phys. Acta 38, 455-9(1955) Mar. (In French)

The complexes of the lanthanons (Ln) with ethylenediaminetetraacetic acid (H_4Y) appear to be very valuable for the separation of the ceric earths. Three separation techniques have been investigated: (1) fractional precipitation of the free complex acids H[LnY], (2) fractional crystallization of their sodium salts in the presence of uncomplexed lanthanon ions and (3) fractional crystallization of their ammonium salts. (auth)

4410

ION EXCHANGE AS A SEPARATIONS METHOD. IX. GRADIENT ELUTION THEORY. Edward C. Freiling (U. S. Naval Radiological Defense Lab., San Francisco). J. Am. Chem. Soc. 77, 2067-71(1955) Apr. 20.

Ion-exchange column theory is applied to elutions made with both discontinuously and continuously graded eluants. Equations are derived for the resulting peak locations and peak widths. These equations are applied to a hypothetical example. The limitations of the theory are discussed. (auth)

SORPTION PHENOMENA

4411 AEC-tr-2135

THE ABSORPTION OF GAS FROM A STREAM OF AIR. II. THE TIME OF PROTECTIVE ACTION OF THE FIRST LAYERS OF AN ADSORBENT BED. M. M. Dubinin, S. I. Parshin, and A. A. Pupyrev. Translated by J. C. Arnell from Zhur. Russ. Fiz. Khim. Obshchestva 62, 1947-51(1930). 5p.

The relation between the time of protective action of a bed of activated charcoal and its length was studied. Chlorine was used in a range of relatively low concentrations and higher velocities of the air-gas mixture. The adsorbent was active charcoal in the form of small particles having a diameter of about 2 mm. (auth)

SPECTROSCOPY

4412 MCC-1023-TR-120

Stanford Univ., Calif.

STUDY OF COMPOUNDS OF BORON BY USE OF NUCLEAR MAGNETIC RESONANCE SPECTRA. FINAL REPORT. Richard A. Ogg, Jr. Jan. 1955. 26p. [For Olin Mathieson Chemical Corp. Contract NOa(s)-52-1023-c].

SYNTHESES

4413 UCRL-4472

California. Univ., Livermore. Radiation Lab.

THE SYNTHESIS AND PROPERTIES OF STYRENE-d_2. Eugene R. Bissell. Mar. 16, 1955. 5p. Contract W-7405-eng-48.

The preparation of styrene-d_2 by catalytic hydrogenation of phenylacetylene is reported together with its physical constants and ultraviolet absorption spectrum. (auth)

TRACER APPLICATIONS

4414 LA-1873UNM

New Mexico. Univ., Albuquerque.

THE EXCHANGE REACTION BETWEEN SUBSTITUTED BENZYL IODIDES AND POTASSIUM IODIDE. IV. p-IODOBENZYL IODIDE. Milton Kahn and J. L. Riebsomer. Dec. 1954. 11p. For Los Alamos Scientific Lab. Subcontract under [W-7405-eng-36].

A measurable exchange has been observed in methanol and ethanol between the iodine atom in p-iodobenzyl iodide and the iodide ion in potassium iodide. The exchange reaction was investigated over a temperature range from 0 to 30.9°. The total iodide concentration in methanol and in ethanol ranged from 0.00158 to 0.0121M and 0.00154 to 0.0112M, respectively. The rate laws for the exchange reaction are $R = 1.71 \times 10^{12} e^{-16,600}$(p-IBzI) (KI) in methanol, and $R = 2.63 \times 10^{12} e^{-16,200}$(p-IBzI) (KI) in ethanol, where the units of R are moles x liter^{-1} x min^{-1}. (auth)

4415 UCLA-334

California. Univ., Los Angeles. Atomic Energy Project.

THE METABOLISM OF THE ESSENTIAL FATTY ACIDS. III. THE ISOLATION OF 5, 8, 11-EICOSATRIENOIC ACID FROM FAT-DEFICIENT RATS. James F. Mead and William H. Slaton, Jr. May 2, 1955. 13p. Contract AT-04-1-GEN-12.

An unsaturated fatty acid which accumulates in male fat-deficient rats has been shown to be 5, 8, 11-eicosatrienoic acid. It is suggested that this acid is not an intermediate in a proposed metabolic pathway for linoleic acid but that it is a reduction product of arachidonic acid. (auth)

URANIUM AND URANIUM COMPOUNDS

4416

AN X-RAY STUDY OF THE SYSTEM URANIUM MONOCARBIDE–URANIUM DICARBIDE–BERYLLIUM CARBIDE. M. C. Burdick, H. S. Parker, R. S. Roth, and E. L. McGandy. J. Research Natl. Bur. Standards 54, 217-29(1955) Apr.

Mixed carbide preparations within the system uranium monocarbide-uranium dicarbide-beryllium carbide were investigated after heating and quenching. X-ray diffraction methods were used to identify the phases found and to determine the degree of interaction. Carbide alloys were studied after treatments at 1,700° and 1,900°C, and a constitutional diagram for the 1,700° C level is presented. No ternary compounds were identified within the system. The limit of solubility of beryllium carbide in uranium monocarbide at 1,700° and 1,900° C was found to be 20 mole percent and 40 mole percent, respectively. Lattice parameters based on x ray patterns in the back-reflection region failed to indicate any other interactions, but evidence is presented to indicate some solid solution among the uranium carbides without lattice parameter change. The room-temperature stability of uranium sesquicarbide (U_2C_3), which has been reported by other investigators, was verified. X-ray diffraction data were obtained for this cubic compound, using CuK_α radiation. (auth)

WASTE DISPOSAL

4417

HOW HANFORD DISCARDS "HOT" EQUIPMENT. Nucleonics 13, No. 5, 32-3(1955) May.

Disposal of "hot" equipment at the Hanford Pu separations plant by burial in isolated areas is described and illustrated photographically. (C.H.)

ENGINEERING

4418 AD-38580

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

ELECTROMECHANICAL PRESSURE GAGES FOR DYNAMIC PRESSURE RECORDING. Dec. 15, 1953. 60p.

Three types of electromechanical pressure gages (strain wire diaphragm, strain wire ferrule, and piezoelectric) are evaluated. The gage parameters such as pressure rise time, pressure range, pressure sensitivity, and acceleration response are examined. (C.W.H.)

4419 WADC-TR-53-293(Pt.5)

Virginia. Univ., Charlottesville. Cobb Chemical Lab.

[HYDRAULIC FLUIDS, LUBRICANTS AND RELATED MATERIALS]. HIGH TEMPERATURE ANTIOXIDANTS FOR SYNTHETIC BASE OILS. PART 5. EVALUATION OF ADDITIVES, SYNTHESIS OF NEW COMPOUNDS, AND MECHANISM STUDIES. James W. Cole, Jr., Gordon P. Brown, and A. Chandler Schmalz. June 1954. 217p. Contract AT33(038)-22947. (AD-45992)

The oxidation characteristics have been determined of various blends of selected additives with fluids of the diester, silicate, silicone and tri-(ortho-chlorophenyl) phosphate types in the absence and presence of aluminum, copper, magnesium, silver, cold-rolled steel and titanium. The temperature range was 200-250°C (400-482°F) with the majority of the runs at 240°C (465°F). A few runs with DC Silicone 550 were conducted at 600 and 700°F. Two experimental methods were employed. One was the previously described standard oxidation-corrosion method in which the fluids were heated under reflux with dry air bubbling through for specified periods of time. The other involves the same test cell, modified for removing small samples of the heated fluid at intervals. Many additives were compared with phenothiazine in di (2-ethylhexyl) sebacate and with phenyl-alpha-naphthylamine in mixed C_8-C_9 silicates. A number showed promise and recommendations are made for further study. (auth)

4420 WADC-TR-53-337(Pt.2)

Southwest Research Inst., San Antonio.

POLYNUCLEAR AROMATIC COMPOUNDS FOR HIGH TEMPERATURE LUBRICANTS. Charles F. Raley, Jr. Feb. 1955. 53p. Contract AF33(616)-276.

The properties of triaryl esters of phosphoric acid were studied with regard to their suitability as high-temperature lubricants and related materials. It was found that naphthyl derivatives did not have sufficient thermal stability to compensate for the unwanted increase in viscosity and melting point. The 4-biphenylyl group possessed all the advantages of the naphthyl group with much better thermal stability. One particular compound prepared, bis(o-chlorophenyl) 4-biphenylyl phosphate had a thermal stability of over 510°C (950°F), by far the highest stability of any compound prepared under this contract. It was found that the chlorophenyl phosphates possessed outstanding thermal stability and seemed to be the most promising type of compound for further development. It was found possible to vary considerably the physical properties of a compound by incorporating three different groups. Finally, the pronounced volatilizing and viscosity-reducing effect of the trifluoromethylphenyl group was observed in several compounds which contained one or more of these groups. It was also found possible to compile a table of approximate thermal decomposition temperatures of numerous aromatic groups. (cf. WADC-TR-53-337.) (auth)

4421 WADC-TR-53-426(Pt.2)

Iowa State Coll., Ames

ORGANO-METALLIC AND ORGANO-METALLOIDAL HIGH-TEMPERATURE LUBRICANTS AND RELATED MATERIALS. Henry Gilman and Richard D. Gorsich. Oct. 1954. 136p. Contract AF33(616)-94.

A preliminary screening is presented of 137 organometallic and organo-metalloidal compounds for thermal stabilities in connection with applications involving high-temperature lubricants. Organosilicon compounds appear to have the most favorable thermal stabilities. (C.W.H.)

4422 WADC-TR-55-102(Pt.1)

Shell Development Co., Emeryville, Calif.

[AIRCRAFT LUBRICANTS]. GREASE LUBRICATION OF HIGH SPEED ANTI-FRICTION BEARINGS. FINAL REPORT. John B. Accinelli and Charles R. Greene. Mar. 1955. 66p. Contract AT 33(616)-2443.

A study of the failure mechanisms of grease lubricated antifriction bearings operating in the DN range from 1.0×10^6 to 2.0×10^6 was made. After necessary rig development work and bearing selection tests, preliminary work on the effect of various grease and operational variables on the performance of ball bearings operating up to DN values of 1.5×10^6 was initiated. The problem seems to be one of maintaining an effective lubricant film on the working surfaces of the bearing under the very strong stripping action of centrifugal force, high sliding velocity, and very high rate of shear. The grease property apparently most critical to lubrication at high speeds is viscosity of the oil. Operation at high (300°F) temperatures also seems to aid lubrication. (auth)

4423

PRESSURE VESSEL WITH INTERNAL WINDOW. F. W. Wells and J. G. Roof (Shell Development Co., Houston, Tex.). Rev. Sci. Instr. 26, 403-4(1955) Apr.

A pressure vessel with full-length internal window has been constructed for phase studies on petroleum hydrocarbon systems in which gas and liquid phases coexist at pressures up to 8000 psi and temperatures of 300°F. A variable volume cell of simple geometry with full visibility of the sample space was used. (L.T.W.)

4424

PROCEEDINGS OF THE AMERICAN POWER CONFERENCE [HELD IN CHICAGO] MARCH 24-25-26, 1954. VOLUME XVI. 677p. plus xxvip. Copies of this book may be obtained by sending advance remittance to: Conference Director, American Power Conference, Illinois Inst. of Tech., Technology Center, Chicago 16, Ill. Price $6.00.

Problems of interest to the power industry and associated lines of endeavor were discussed at this conference by various experts in the fields. Among the topics

discussed were the economic aspects of various types of nuclear reactors, the technology of high-pressure water reactor systems, and problems of nuclear powerplant operation. (C.H.)

AEROSOLS

4425

AIR STERILIZATION BY FIBROUS MEDIA. Arthur E. Humphrey and Elmer L. Gaden, Jr. (Columbia Univ., New York). Ind. Eng. Chem. 47, 924-30(1955) May.

The mechanics of the removal of microörganisms from air streams by fibrous filters are discussed. Results of aerosol filtration by glass wool filter beds are presented and analyzed. (C.W.H.)

4426

MODERN ELECTRICAL PRECIPITATION. Harry J. White (Research-Cottrell, Inc., Bound Brook, N. J.). Ind. Eng. Chem. 47, 932-9(1955) May.

Basic principles of modern electrical precipitation are presented. Equations are derived for particle collection efficiencies. Factors for optimum precipitator performance are included. (C.W.H.)

4427

COLLECTING HIGH RESISTIVITY DUSTS AND FUMES. LABORATORY PERFORMANCE OF A SPECIAL TWO-STAGE PRECIPITATOR. Wayne T. Sproull (Western Precipitation Corp., Los Angeles). Ind. Eng. Chem. 47, 940-4 (1955) May.

Experimental results indicate that a modified two-stage precipitator may be used for collecting materials that have a resistivity of 10^{11} to 10^{13} ohm-cm. (C.W.H.)

4428

MECHANICAL ELECTROSTATIC CHARGING OF FABRICS FOR AIR FILTERS. Leslie Silverman, Edward W. Conners, Jr., and David M. Anderson (Harvard School of Public Health, Boston). Ind. Eng. Chem. 47, 952-60(1955) May.

Test results are presented in which a mechanically induced electrostatic charge on certain fabrics is employed as an aid in the removal of particulate matter (atmospheric dust) from air at room temperature. The theory of mechanically induced static charges and some experimental data are presented. A so-called tribo-electric series of common fibers is developed. The electrostatic mechanism of aerosol filtration for the three most important precipitating forces is described. (auth)

4429

SOURCES OF AIR POLLUTION LITERATURE. Janet B. Murk (Allied Chemical and Dye Corp., Edgewater, N. J.). Ind. Eng. Chem. 47, 976-81(1955) May.

Some techniques of gathering and digesting air pollution literature are discussed. Reference lists are included for bibliographies, periodicals, abstracting publications, and organizations. (C.W.H.)

HEAT TRANSFER AND FLUID FLOW

4430 HE-150-86

California. Univ., Berkeley. Inst. of Engineering Research.

PRELIMINARY STUDIES OF NITROGEN GLOW PRODUCTION FOR USE IN THE GLOW METHOD OF FLOW VISUALIZATION. R. A. Evans and J. L. Olmstead. July 31, 1951. 14p. Contract AF33(038)-8896. (U-21676)

In the glow method of flow visualization, N is excited and continues to glow as it passes through a wind tunnel test region. Shock waves and other features of flow involving density changes become visible. The production of glow has been investigated in a preliminary manner. Several tentative relationships between the effects of glow intensity and discharge current, electrode history, flow rate, and pressure have been established. The effects of corrosion of the cathode has been investigated. An r-f discharge about equal to the d-c discharge in glow intensity has been produced. (M.P.G.)

4431 HE-150-107

California. Univ., Berkeley. Inst. of Engineering Research.

FLOW VISUALIZATION USING AIR AFTERGLOW EXCITED BY A CROSS STREAM 60 CYCLE DISCHARGE. W. B. Kunkel. Aug. 26, 1952. 18p. Contract AF33(038)-8896. (U-24971)

A powerful 60 cps cross-stream glow discharge between water-cooled Kovar electrodes was used to excite reproducible afterglow in air. The afterglow intensity in a low density supersonic stream was such that good shock-wave photographs could be obtained with exposure times of the order of one min. Excessive heating of all metal surfaces exposed to the active gas, however, prevented the use of pressure probes to determine the flow properties of the glowing stream. If pulsed operation and cooling of probes and models are applied the method is considered useable. Since the glow characteristics are not yet known, quantitative interpretation of the photographs is not yet possible. (auth)

4432 NACA-TN-2783

California. Univ., Berkeley.

USE OF A CONSOLIDATED MEDIUM FOR MEASUREMENT OF FLOW RATE AND VISCOSITY OF GASES AT ELEVATED PRESSURES AND TEMPERATURES. Martin B. Biles and J. A. Putnam. [Oct. 9, 1950]. 51p.

Use of a consolidated porous medium as a gas-metering device and for determination of gas viscosity has been investigated over a moderate range of temperature and pressure. With normal laboratory techniques it appears possible to calibrate large porous Alundum filtering thimbles to meter gas with a probable error of 0.1 to 0.2%. The geometry of such elements permits an appreciable range of gas flow rate to be metered with small, accurately controlled, pressure drops. The advantages of such a device warrant its use as a laboratory instrument. Results of the flow tests have been employed in the determinations of the viscosity of air up to approximately 900 psi absolute at the two test temperatures of 75 and 517°F. These data appear to check sufficiently well with other published viscosity data to justify the use of this method as a recommended procedure. (auth)

4433 NACA-TN-3451

Lewis Flight Propulsion Lab., Cleveland.

ANALYSIS OF FULLY DEVELOPED TURBULENT HEAT TRANSFER AND FLOW IN AN ANNULUS WITH VARIOUS ECCENTRICITIES. Robert G. Deissler and Maynard F. Taylor. [Mar. 16, 1955]. 42p.

A previous analysis for turbulent heat transfer and flow in tubes was generalized and applied to an annulus with various eccentricities. Expressions for eddy diffusivity which were varified for flow and heat transfer in tubes were assumed to apply in general along lines normal to a wall.

Velocity distributions, wall shear-stress distributions, and friction factors, as well as wall heat-transfer distributions, wall temperature distributions, and average heat-transfer coefficients, were calculated for an annulus having a radius ratio of 3.5 at various eccentricities. (auth)

4434 IG-Trans-(R)-3

AN INVESTIGATION OF THE MAXIMUM HEAT FLUX DURING THE BOILING OF WATER IN VERTICAL TUBES. S. M. Lukomskii. Translated by E. Bevitt from Doklady Akad. Nauk S.S.S.R. 80, 53-6(1951). 6p.

4435 TT-536

HEAT TRANSFER FROM URANIUM TO ALUMINIUM OR ANTICORODAL. (Waermeuebergang Von Uran Auf Aluminium Bzw. Anticorodal). R. Risch. Translated by D. A. Sinclair from Arbeitsgemeinschaft Kernreaktor, Schweiz, Internal Report No. 8, 1954. 9p.

The heat-transfer resistance between Al and U was investigated by two kinds of measurements. In the first arrangement (a U cylinder in a sleeve of anticorodal) the heat was transmitted, just as in a reactor, radially outwards to the sleeve. Test results showed the temperature gradient between the Al and U to depend very strongly on temperature. In the second case heat flowed axially through a column of four U disks and five Al plates, the average disk temperature being held constant at 100°C. The temperature drop increased constantly and linearly with time. (L.M.T.)

VACUUM SYSTEMS

4436

USE OF A^{37} TO DETERMINE ARGON BEHAVIOR IN VACUUM SYSTEMS. Donald R. Carr and J Laurence Kulp (Columbia Univ., Palisades, N. Y.). Rev. Sci. Instr. 26, 379-81(1955) Apr.

By employing A^{37} as a tracer it has been possible to show that quantities of argon as small as 10^{-9} cc can be circulated in a vacuum system containing furnaces, charcoal traps, electrical discharges, and stopcocks without measurable loss of argon. Further, it is shown that argon is not desorbed from charcoal at liquid air temperatures in appreciable quantities during prolonged evacuation. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

4437 NYO-6618

Carnegie Inst. of Tech., Pittsburgh. Metals Research Lab. ELECTROCHEMICAL STUDIES OF NON-AQUEOUS MELTS. QUARTERLY PROGRESS REPORT FOR THE PERIOD ENDING MARCH 15, 1955. R. F. Mehl and G. Derge. May 1955. 6p. Contract AT(30-1)-1024.

Preliminary results are given for the self-diffusion of iron in molten carbon-saturated iron. An attempt to melt TiS_2 in an induction furance under an argon atmosphere at temperatures as high as 1700°C proved unsuccessful. The current efficiencies of electrolysis of a 12.7% MnO–49.9% FeO–27.4% SiO_2 slag are presented. (For preceding period see NYO-6617.) (L.M.T.)

4438

DISPERSION OF RADIOELEMENTS OF THE URANIUM–RADIUM FAMILY IN NATURAL WATERS. R. Coulomb. Bull. soc. franc. mineral. et crist. 78, 89-96(1955) Jan.-Ma (In French)

CERAMICS AND REFRACTORIES

4439

NEW REFRACTORY USES FOR SILICON NITRIDE REPORTED. J. F. Collins (Electro Metallurgical Co., Niagara Falls, N. Y.) and R. W. Gerby (Metals Research Labs., Niagara Falls, N. Y.). J. Metals 7, 612-15(1955) May.

Fabrication, physical and mechanical properties, and resistance of Si nitrides to oxidation and to attack by chemicals and liquid metals are discussed, and applications are briefly summarized. (L.M.T.)

4440

MATERIALS FOR HIGH TEMPERATURE SERVICE. INCREASING INTEREST IN BORIDE-BASE PRODUCTS. Metallurgia 51, 185-6(1955) Apr.

A study was made of the development of boride base materials using Zr boride, Cr boride, and Mo boride as refractory components, silicide materials on the basis of Cr or Mo disilicide, and Al_2O_3 and Cr materials. Preparation of the borides by powder metallurgy is discussed. (J.E.D.)

CORROSION

4441

RESULTS OF SOME MARINE-ATMOSPHERE CORROSION TESTS ON MAGNESIUM–LITHIUM ALLOYS. P. D. Frost, F. W. Fink, H. A. Pray, and J. H. Jackson (Battelle Memorial Inst., Columbus, Ohio). J. Electrochem. Soc. 102, 215-18 (1955) May.

Magnesium–lithium binary alloys which contain just enough lithium (about 11 wt. %) to produce a single-phase, body-centered cubic structure have shown surprisingly good resistance to corrosion in 3% salt solution. High-strength alloys having about 9% lithium and various quantities of aluminum, zinc, and other elements have a mixed hexagonal-plus-body-centered cubic structure. Such alloys generally have poorer corrosion resistance than the single-phase binaries. Three of the high-strength alloys were exposed for 32 months to the sea-coast atmosphere near Daytona Beach, Florida. For comparison purposes, samples of commercial AZ31A-H24 alloy were exposed at the same time. All alloys were in the form of 4 × 6 × 0.064 in. panels. The AZ31A sheet had corrosion resistance only slightly superior to that of an alloy containing Mg–8.7% Li–5% Al–8% Zn. The other two alloys, Mg–8.8% Li–7% Al–0.05% Sn–1% Mn and Mg–8.8% Li–7% Al–1% Sn, had much poorer corrosion resistance. (auth)

4442

THE INTERACTIONS OF STATIC STRESS AND CORROSION WITH ALUMINIUM ALLOYS. F. A. Champion (British Aluminium Co., Ltd., Gerrards Cross, Bucks, England). J. Inst. Metals 83, 385-92(1955) Apr.

Existing knowledge from laboratory experiments and service experience on the susceptibility of aluminum alloys to stress-corrosion and on methods of protection is reviewed, with particular reference to practical implications. It is important to distinguish between alloys that are liable to fail by stress-corrosion and those that are not. Precautions can then be taken in appropriate cases, and unnecessary precautions and restrictions avoided in others. If precautions are taken with the few alloys that are susceptible,

the risk of stress-corrosion failure in service is extremely small. (auth)

4443

HIGH TEMPERATURE CORROSION DATA. A COMPILATION BY TECHNICAL UNIT COMMITTEE T-5B ON HIGH TEMPERATURE CORROSION. Corrosion 11, 241t-5t(1955) May.

The behavior of 31 materials ranging from cast iron to lead, including a number of stainless steels and high alloys subjected to temperatures over 400F is tabulated. Corrosion rates are indicated as low, moderate, or high versus specific temperatures. Additional data are solicited by the compiling committee. (auth)

GEOLOGY AND MINERALOGY

4444

AGE DETERMINATIONS ON SOME ROCKS FROM THE BOULDER BATHOLITH AND OTHER BATHOLITHS OF WESTERN MONTANA. Randolph W. Chapman, David Gottfried, and Claude L. Waring. Bull. Geol. Soc. Amer. 66, 607-10(1955) May.

4445

THE Pb^{207}/Pb^{206} AGES OF SOME STONE METEORITES. Claire C. Patterson (California Inst. of Tech., Pasadena). Geochim. et Cosmochim. Acta 7, 151-3(1955) Apr.

The isotopic compositions have been determined for the leads isolated from three stone meteorites. Based upon certain assumptions, Pb^{207}/Pb^{206} ages of about 4.5×10^9 years are calculated for the meteorites. The lead data indicate that the concentrations of uranium should be about 0.1 ppm and the concentrations of thorium should be about 0.5 ppm in stone meteorites. (auth)

4446

PHOTOGEOLOGIC MAP OF THE EMERY-7 QUADRANGLE, EMERY COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-10. H. S. Bennett. Washington, U. S. Geological Survey, 1955. $0.50.

4447

PHOTOGEOLOGIC MAP OF THE EMERY-10 QUADRANGLE, EMERY COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-11. H. S. Bennett. Washington, U. S. Geological Survey, 1955. $0.50.

4448

PHOTOGEOLOGIC MAP OF THE CIRCLE CLIFFS-1 QUADRANGLE, GARFIELD COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-17. J. S. Detterman. Washington, U. S. Geological Survey, 1955. $0.50.

4449

PHOTOGEOLOGIC MAP OF THE CIRCLE CLIFFS-2 QUADRANGLE, GARFIELD COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-18. R. J. Hackman. Washington, U. S. Geological Survey, 1955. $0.50.

4450

PHOTOGEOLOGIC MAP OF THE CIRCLE CLIFFS-3 QUADRANGLE, GARFIELD COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-19. J. S. Detterman. Washington, U. S. Geological Survey, 1955. $0.50.

4451

ON THE PROPERTIES AND SYNTHESIS OF SEVERAL URANIFEROUS MINERALS. Claude Bignand (Laboratoire de Minéralogie de la Sorbonne, Paris). Bull. soc. franc. mineral. et crist. 78, 1-26(1955) Jan.-Mar. (In French)

METALS AND METALLURGY

4452 NAA-SR-1111

North American Aviation, Inc., Downey, Calif.

IMPERFECTIONS IN COPPER IN TERMS OF ELECTRICAL RESISTIVITY AND THERMOELECTRIC POWER. George W. Rodeback. May 1, 1955. 26p. Contract AT-11-1-GEN-8.

Certain types of imperfections in Cu may be studied by including the Fermi energy dependence of their electron scattering in the expressions for electrical resistivity and thermoelectric power. Measurements of electrical resistivity and thermoelectric power from 130 to 300°K have been made on variously annealed specimens of cold-worked Cu, and the results have been compared with the predictions of the theoretical calculations. Data also have been taken on a sample bombarded at 150°K with 35 Mev α particles to an integrated flux of 1.7×10^{17} particles per cm^2 and subsequently annealed at room temperature. Two types of imperfections which contribute to the nonthermal scattering of conduction electrons are considered: (1) fixed point scatterers whose scattering probability per unit time is assumed to have a one-half power dependence on the Fermi energy; (2) boundary scatterers whose scattering probability is assumed to be energy independent. When the imperfections due to cold work are assumed to be fixed point scatterers, application of the free electron theory yields a Fermi energy constant over the ranges of annealing and temperatures of measurement. The same Fermi energy is found above 240°K for the radiation-damaged Cu if the imperfections remaining after room temperature annealing are assumed to be boundary scatterers. The possibilities of identifying the specific types of imperfections are discussed. (auth)

4453 NAVORD-2073

Naval Ordnance Test Station, Inyokern (China Lake), Calif.

PHASE EQUILIBRIA STUDIES; A NEW METHOD OF INDEXING PHASE REACTIONS AND CURIE POINTS IN METALS AND ALLOYS. Richard D. Potter. Nov. 27, 1953. 48p. (AD-27310)

A new method of determining and recording phase change reactions and Curie points in metals and alloys is described. The basis of the technique is the utilization of a thermoelectric effect of the sample material. This effect was first observed in measuring the electrical resistance of samples heated and cooled through their critical temperature ranges. To obtain automatically recorded data, copper wires were brazed to the ends of a short coil of the sample. The coil was then placed in series with a millivolt potentiometer and a millivolt recorder. The recorder measured the output voltage of the potentiometer as affected by the resistance of the sample. Changing the voltage output of the potentiometer resulted in recorder response which indicated that the sample was contributing an emf to the circuit. The sharp changes in the recorded data over the phase reaction range were shown to be associated with the phase reaction. (auth)

4454 NP-5629

New York Univ., New York. Coll of Engineering.

THERMODYNAMIC STUDY OF SOLID SOLUTIONS. FINAL

REPORT. VAPOR PRESSURE OF CADMIUM OVER ALPHA Ag–Cd ALLOYS AND ALPHA AND BETA Au–Cd ALLOYS. P. Herasymenko. Jan. 31, 1955. 56p. Contract DA-30-069-ORD-1004.

A new method of measurement of partial vapor pressures over solid alloys has been developed. Solid alloys are formed at elevated temperatures from pure components — one of them being present in vapor form at constant partial pressure – until equilibrium with vapor is reached. The pressure of the volatile element is maintained constant by keeping the pure volatile element in liquid form at constant temperature at the low-temperature end of the reaction vessel. Partial vapor pressures of cadmium were measured in the whole alpha field for the Ag–Cd system. The partial heats and entropy of solution of cadmium in silver show abrupt changes at about 4.1, 8.33, 25, and 33.3 at. % Cd. Similar measurements were carried out in the alpha and beta field of the Au–Cd system. Abrupt changes in partial thermodynamic functions were found at 16.6, 25, and 33 at. % Cd in the alpha field and at 50 at. % in the beta field. These changes are due to changes in ordering. (auth)

4455 NP-5631

Massachusetts Inst. of Tech., Cambridge.

THE EFFECT OF COMPOSITION AND STRUCTURE ON THE CREEP RUPTURE PROPERTIES OF 18-8 STAINLESS STEELS. Forest C. Monkman, Peter E. Price, and Nicholas J. Grant. [1953?]. 35p.

Twenty-seven simple unstabilized stainless steels of the 18 chromium–8 nickel variety were prepared in which amounts of chromium, nickel, and carbon plus nitrogen were varied. Stress-rupture tests were conducted on these alloys at temperatures of 1000, 1200, and 1300°F for rupture lives of about thirty seconds to five hundred hours. Variations in the chromium, nickel, or carbon plus nitrogen contents while holding the other two constant were studied to establish the effects of such composition changes on the strength and structure of the alloys at elevated temperatures. The effects of the formation and growth of carbides, ferrite, and sigma during testing were evaluated. (auth)

4456 NP-5632

Massachusetts Inst. of Tech., Cambridge.

MECHANISM OF INTERCRYSTALLINE FRACTURE. H. C. Chang and Nicholas J. Grant. [1954?]. 38p.

Microscopic observations during creep tests were made on 20% Zn–Al, 80 Ni–20 Cr, and 2S and 3S aluminum specimens. All these materials failed in an intercrystalline manner under certain stress and temperature conditions. Particular attention was given to the initiation and propagation of intercrystalline cracks in coarse grained 20% Zn–Al specimen. The geometry of the grains and grain boundaries in these specimens was known before the tests. On the basis of the observations and a knowledge of the interaction between grains and grain boundaries, a mechanism of intercrystalline fracture and propagation of the fracture has been proposed. (auth)

4457 NRL-4523

Naval Research Lab., Washington, D. C.

EFFECT OF RARE-EARTH ADDITIONS ON THE HIGH-TEMPERATURE PROPERTIES OF A COBALT-BASE ALLOY. J. E. Breen and J. R. Lane. Apr. 12, 1955. 19p.

Improvements in the high-temperature mechanical properties of a typical cobalt-base alloy were achieved by the addition of rare earths as misch metal. Three alloys of the same base composition but with 0 to 2% rare earths added were cast from a split heat. Stress rupture tests were run at 1500, 1600, and 1700°F. The high-temperature strength and ductility were increased in both as-cast and aged material at all temperatures, with the greatest benefit occurring at 1500°F. No improvements in room-temperature tensile properties were noted. (auth)

4458 NYO-7044

Massachusetts Inst. of Tech., Cambridge.

SOLID SOLUTIONS AND GRAIN BOUNDARIES. PROGRESS REPORT NO. 25. B. L. Averbach, M. Cohen, F. Herbstein, J. Hilliard, and R. Kaplow. Mar. 31, 1955. 3p. Contract AT(30-1)-1002, Scope II.

The statuses of thermodynamic and x-ray measurements which are being made on several systems for a study of the fundamental behavior of solid solutions are summarized. No technical data are included. (For preceding period see NYO-7043.) (L.M.T.)

4459 NYO-7074

Massachusetts Inst. of Tech., Cambridge.

FUNDAMENTALS OF COLD WORKING AND RECRYSTALLIZATION. PROGRESS REPORT NO. 18. B. L. Averbach, M. Cohen, S. Allen, M. F. Comerford, and C. Houska. Mar. 31, 1955. 3p. Contract AT(30-1)-1002, Scope III.

It has been found that polycrystalline samples of alpha brass are more convenient than single crystal samples for studies of recovery and recrystallization. Preliminary data suggest that the recovery process involves a reduction in the local elastic strains along with a slow subgrain size increase. (For preceding period see NYO-7073.) (L.M.T.)

4460 OSR-TN-54-359

Columbia Univ., New York. [School of Engineering.]

CREEP-RUPTURE BY VACANCY CONDENSATION. E. S. Machlin. Nov. 1954. 26p. Contract AF-18-600-899. (CU-7-55-AF-899-Met.)

The possibility that formation of voids under creep-rupture conditions may take place by the condensation of vacancies has been investigated theoretically. It has been concluded that nucleation of voids under creep-rupture conditions by vacancy condensation is highly improbable. However, growth of pre-existant voids by vacancy condensation is probable. A number of predictions made in this theory have been verified by the data. Namely, the elongation at which voids just become visible has been predicted and found in good agreement with experiment. It has been predicted and been checked that the product of rupture life and steady-state creep rate for preannealed metals and single phase alloys is an invariant quantity independent of stress, temperature, and atomic number for a given type structure. The direction of the effect of cold work on this product has been predicted and found in agreement with experiment. A number of experiments to further evaluate the vacancy condensation mechanism are described. (auth)

4461 WADC-TR-54-87

Illinois, Univ., Urbana

[CERAMIC COATINGS FOR AIRCRAFT POWER PLANTS]. PROTECTIVE CERAMIC COATINGS FOR TITANIUM. Dwight G. Bennett, W. J. Plankenhorn, and Herbert R. Toler. Nov. 1953. 37p. Contract AF33[616]-320, [Report No. 67]. (AD-29828)

Temperatures of 1400 to 1800°F were employed to study the effects of ceramic coatings on the physical and met-

allurgical changes in Ti and its alloys. Coatings originally designed for application to Fe or low-alloy-content metals and stainless steels were successfully applied to Ti. Such coatings furnished protection against oxidation at temperatures up to and including 1700°F. The degree of oxidation was determined by the gain in weight for the coated and uncoated specimens. Properly selected coatings were shown to retard embrittlement of Ti at temperatures up to 1500°F as measured by impact resistance and indicated by metallurgical examination. Ceramic coatings prepared from frits which had been vacuum melted after the initial smelting and quenching were effective in protecting the metal against embrittlement. Results are given on the effect of 100 hr heating on the impact resistance of 2 mill heats of Ti–75A. The embrittlement of Ti–75A as a function of time and temperature and the effect of temperature on the embrittling rate of RC-130A are given in table form. Data on the effects of ceramic coating on impact strength of Ti are also included. (auth)

4462 WADC-TR-54-355

Battelle Memorial Inst., Columbus, Ohio.

[HEAT TREATMENT OF TITANIUM ALLOYS]. PRECIPITATION HARDENING AND EMBRITTLEMENT OF HIGH-STRENGTH TITANIUM ALLOYS. H. A. Robinson, M. W. Parris, A. E. Austin, C. M. Schwartz, and P. D. Frost. Dec. 1954. 81p. Contract AF33(616)-445.

Representative alloys of the Ti–Cr, Ti–Fe, and Ti–Mo systems were quenched to retain the beta phase and aged at temperatures in the range 500 to 1000°F for periods up to 1000 hours. The changes which occurred in the alloys were followed by means of x-ray diffraction, hardness, and electrical resistivity. From this data it was concluded that the decomposition of the retained beta phase occurred in three major stages: (1) Precipitation of a metastable transition phase, omega, which apparently causes age hardening. At the same time the beta phase seems to become locally enriched in alloy. Hardness increased to very high values during this stage. (2) The omega phase disappears and the alpha phase makes its appearance. The remaining beta phase becomes highly enriched in alloy. Both hardness and resistivity decrease sharply during this stage. (3) In the eutectoid systems (Ti–Cr and Ti–Fe), the highly enriched beta decomposes into alpha plus compound. In the Ti–Fe alloys, this stage was accompanied by a further drop in hardness and resistivity. In the Ti–Cr system there is little change in these properties. (auth)

4463 WAL-401/147-21

New York Univ., New York. Coll. of Engineering.

BETA PLASTICITY IN TITANIUM-BASE ALLOYS. FINAL REPORT. Paul A. Albert. Oct. 15, 1954. 72p. Contract DA-30-069-ORD-869.

The modes of deformation of beta Ti–V alloys were studied. Eight single crystals were pulled in tension and the inception of slip determined visually. The deformation markings of the crystals were determined as consisting of slip traces and of kink bands. All deformation markings were determined crystallographically by two-surface analysis. (auth)

4464

A HIGH-RESOLUTION METALLOGRAPH FOR ELEVATED TEMPERATURES. J. E. Jenkins, D. R. Buchele, and R. A. Long (Lewis Flight Propulsion Lab., Cleveland, Ohio). Metal Progr. 67, No. 5, 101-4(1955) May.

The components of a metallograph, modified for studies at elevated temperatures, are described. Details of the microscope hot stage and the optical system are presented. The microstructure of a stainless steel specimen was observed at temperatures from 80° to 1650°F. (C.W.H.)

4465

WELDING CRACKS IN COLUMBIUM-BEARING STAINLESS STEEL. Metal Progr. 67, No. 5, 109-11(1955) May.

Improved welding techniques and modifications of niobium steels have minimized the difficulties encountered in welding due to cracking in the weldment. (C.W.H.)

4466

LUBRICANTS FOR TITANIUM. Ernest Rabinowicz and E. P. Kingsbury (Massachusetts Inst. of Tech., Cambridge). Metal Progr. 67, No. 5, 112-14(1955) May.

Several organic compounds were investigated as possible lubricants on clean titanium surfaces. Only synthetic long-chain compounds and halogenated hydrocarbons provided fair lubrication. (C.W.H.)

4467

HYDROGEN EMBRITTLEMENT OF TITANIUM ALLOYS. Harris M. Burte, Eugene F. Erbin, George T. Hahn, Ralph J. Kotfila, John W. Seeger, and Donald A. Wruck (Wright Air Development Center). Metal Progr. 67, No. 5, 115-20(1955) May.

Hydrogen contamination in α-β titanium alloys can cause low ductility in tensile tests, brittle fracture in rupture tests, low load carrying capacity, and increased susceptibility to embrittlement at elevated temperatures. (C.W.H.)

4468

THE USE OF CREEP-RESISTING STEELS IN STEAM POWER PLANTS. H. W. Kirby (Brown-Firth Research Labs., Sheffield, England). Metallurgia 51, 165-70(1955) Apr.

In several new British power stations the steam turbines have been designed to operate at 1,050°F (566°C) steam temperature and 1,500 lb./sq. in. pressure, and the selection of steels for the main steam piping is perhaps, one of their most interesting features, as at 1050°F, consideration has to be given to the relative merits of ferritic and austenitic steels. In reviewing the influence of these and higher operating conditions on constructional materials, steels for piping, turbine rotors, turbine blades and bolts are discussed. (auth)

4469

RECLAIMING ZIRCONIUM CHIPS FOR ARC-MELTING FEED STOCK. Metallurgia 51, 179-80(1955) Apr.

When zirconium is machined, the chips are contaminated with such elements as iron, aluminium, silicon, carbon and oxygen, and remelting such material produces ingots whose hardness is higher than that of the original material. Techniques for the removal of the contaminants are discussed here. (auth)

4470

HIGH TEMPERATURE PROPERTIES OF IRON-RICH Fe–Mo ALLOYS. S. F. Reiter (Rome Fastener Corp., New Haven, Conn.) and W. R. Hibbard, Jr. (General Electric Co., Schenectady, N. Y.). J. Metals 7, 655-63(1955) May.

A survey of the effect of heat treatment on the room temperature hardness of Fe–Mo alloys has been made. Constant strain rate tensile tests were performed between room temperature and 1800°F. These data were analyzed to determine the effect of temperature and composition on the

strain hardening coefficient and strain rate sensitivity. Constant load creep-rupture tests were made on these alloys and the results related to composition and structure. A relation between the high temperature strength of the precipitation hardened alloys and the volume of precipitate has been observed. (auth)

4471

THE SYSTEM URANIUM–TUNGSTEN. D. Summers-Smith (Imperial Chemical Industries, Ltd.). J. Inst. Metals 83, 383-4(1955) Apr.

The solubility of uranium in tungsten and that of tungsten in uranium have been investigated in arc-melted alloys by x rays, dilatometry, and metallography. At 1000°C, the solubility of tungsten in γ-uranium is about 0.9 ± 0.3 at. %; that of uranium in tungsten about 0.1 at. %. The small influence of tungsten on the uranium transformation temperatures suggests that the solubility of tungsten in α- and β-uranium is very slight. These results confirm the work of Schramm, Gordon, and Kaufmann (Trans. Amer. Inst. Min. Met. Eng. 188, 195 (1950)). (auth)

4472

ON THE ORDERED PHASES OF Cu–2% Be ALLOYS. Arunachala Viswanathan. Compt. rend. 240, 1428-30(1955) Mar. 28. (In French)

Tempering a Cu–2% Be alloy at 750°C reveals the existence of a tetragonal γ′ phase. Annealing returns the alloy to the γ phase. (tr-auth)

4473

Al–Th INTERMETALLIC COMPOUNDS. II. P. B. Braun and J. H. N. van Vucht(Philips Research Labs., Eindhoven, Netherlands). Acta Cryst. 8, 246(1955) Apr.

Data on crystal structure are presented for three additional Al–Th compounds: Al Th, Al Th_2, and Al_7 Th_4. (C.W.H.)

4474

PRELIMINARY INVESTIGATION OF HAFNIUM METAL BY THE KROLL PROCESS. H. L. Gilbert and M. M. Barr (U. S. Bureau of Mines, Albany, Oreg.) J. Electrochem. Soc. 102, 243-5(1955) May.

Several hundred pounds of hafnium metal of better than 98% purity have been produced by the Kroll process of magnesium reduction of the tetrachloride. A discussion of the process from oxide to metal stages is given with thermodynamic values for chlorination and reduction. Metal produced to date is hot malleable but not cold ductile. (auth)

4475

ELECTROLYTIC REDUCTION OF TITANIUM MONOXIDE. M. E. Sibert, Q. H. McKenna, M. A. Steinberg, and E. Wainer (Horizons Inc., Cleveland, Ohio). J. Electrochem. Soc. 102, 252-62(1955) May.

An electrolytic method for preparation of titanium metal from titanium monoxide is described. The process is carried out in alkaline earth halide melts under an inert atmosphere. The inert atmosphere cell and its operation are described. Methods for preparation of reduced titanium oxides are also discussed. These include reactions of titanium carbide with ZnO or MgO, carbon reduction of TiO_2, and electrolytic reduction of TiO_2. Electrolytic titanium prepared from TiO is deposited as a crystalline metal powder in a salt matrix and is recovered by aqueous techniques. Although metal so prepared has not generally been acceptable from a purity standpoint, revision in cell design and procedure could offer improvement in this respect. (auth)

PHYSICS

4476 AEDC-TR-54-32

Arnold Engineering Development Center, Tullahoma, Tenn.

DIGITAL MANOMETER READER FOR THE ARNOLD ENGINEERING DEVELOPMENT CENTER. Henry T. Chapek. Jan. 1955. 34p.

The development of a prototype digital manometer reader system is described. The theory, operation, and description of the prototpye are presented. Recommendations are made for the construction of a digital manometer reader system which will read in binary digital form a 120-in. multitube manometer board in approximately 5 seconds and feed the results to a digital computer. The heights of the columns are to be read to an accuracy of 0.020 in. (auth)

4477 ANL-5417

Argonne National Lab., Lemont, Ill.

SATURATION OF VAPOR IN A KNUDSEN EFFUSION OVEN. R. J. Thorn. Mar. 21, 1955. 9p. Contract W-31-109-eng-38.

A mathematical analysis of the Knudsen effusion method for the measurement of vapor pressure shows that the Clausing factors at the orifice are not of appreciable importance for a properly designed cell, the Clausing factors as such at the cell wall do not have to be considered, and the numerical value of the vaporization coefficient is not important in a well designed cell nor is its angular dependence. (C.W.H.)

4478 CERN-PS/PL-2

[European Organization for Nuclear Research, Geneva.]

ETUDE GRAPHIQUE DES TRAJECTORIES. REPRESENTATION DANS L'ESPACE DES PHASES. (Graphic Study of Trajectories. Representation in Phase Space). Feb. 1955. 41p.

A method is proposed for providing graphical solutions to complicated equations of motion for particles in electromagnetic fields. The concept of phase space is used to describe the position and motion of particles by 3 position and momentum coordinates. A precision of 5% is obtained when applied to linear systems. (K.S.)

4479 NP-5622

Massachusetts Inst. of Tech., Cambridge. Solid-State and Molecular Theory Group.

QUARTERLY PROGRESS REPORT NO. 15. Apr. 15, 1955. 54p. Contract N5ori-07856.

A method is discussed for overcoming the difficulties of orthogonality between pairs of orbitals in the extended valence-bond method of the previous progress report. The considerations are applied to methane, diamond, ethylene, benzene, and metals. A table of one-electron energies for free atoms has been made current on the basis of revised data. Tentative results on the calculation of impurity wave functions for degenerate bands in the transition elements are reported. Other activities are discussed on polarization effects in the fluorine ion, the computation of atomic integrals and integral transformations, energy bands in graphite, and the enhancement of electron-lattice interactions occurring in the presence of a periodic potential. (For preceding report in series see NP-5362.) (K.S.)

4480 NP-5624

Illinois Inst. of Tech., Chicago.

CHEMICAL THERMODYNAMICS OF MATERIALS AT

HIGH TEMPERATURES. TECHNICAL REPORT NO. 15. MECHANISMS OF PERMEATION OF SILVER, COPPER, AND MERCURY GASES OF SOLID GRAPHITE WALLS. Russell K. Edwards and James H. Downing. Mar. 1955. 21p. Contract Nonr-1406.

Volatilization measurements conducted with mercury, silver, and copper liquids from National Carbon graphite containers of grade AGX show that mercury and silver may pass through the walls by the mechanism of capillary flow whereas copper passes through the walls by activated diffusion. The activation energy found in the latter case was 20.7 kcal for the containers used. (auth)

4481 NRL-4542

Naval Research Lab., Washington, D. C.
AN EXAMINATION OF THE 1948 LIQUID HELIUM VAPOR PRESSURE-TEMPERATURE SCALE. J. R. Clement, J. K. Logan, and J. Gaffney. [Apr. 25, 1955]. 24p.

Measurements using a carbon resistance thermometer show that errors probably exist in the 1948 liquid helium vapor pressure-temperature scale. The resistance data themselves do not allow an estimation of these errors. Various authors have proposed corrections to the 1948 temperature scale. Applying these corrections significantly smooths the resistance thermometer data. In addition, the 1948 temperature scale has been compared with calculated temperature scales. This comparison shows significant structure in the 1948 scale itself. (auth)

4482 NYO-6325

Pittsburgh Univ.
THE HEAT CAPACITIES OF POTASSIUM BETWEEN 12 AND 320°K AND THE ENTROPY OF POTASSIUM AT 25°C. PROGRESS REPORT FOR JANUARY 1, 1955 TO APRIL 1, 1955. W. E. Wallace, R. S. Craig, and C. A. Krier. Apr. 6, 1955. 12p. Contract AT(30-1)-647.

Results of heat capacity measurements on potassium between 12 and 320°K are presented and compared with recent but unpublished data obtained at another laboratory. The entropy of potassium at 25°C is found to be 15.39 ± 0.03 e.u. per gram atom. The variation of the Debye θ with temperature between 12 and 130°K is shown. (auth)

4483 ORNL-1872

Oak Ridge National Lab., Tenn.
CALCULATED DEPTH DOSE CURVES IN TISSUE FOR BROAD BEAMS OF FAST NEUTRONS. Walter S. Snyder and J. Neufeld. May 5, 1955. 35p. Contract W-7405-eng-26.

4484 PRL-5.14

Pennsylvania State Univ., State College. Petroleum Refining Lab.
FLUIDS, LUBRICANTS, FUELS, AND RELATED MATERIALS. QUARTERLY REPORT FOR JANUARY, FEBRUARY, AND MARCH 1955. Mar. 31, 1955. 88p. Contract AF33(616)-2851.

(For preceding period see PRL-5.13.)

4485

METHOD OF RECORDING THE DECAY OF PHOSPHORESCENCE. Kristian Skarsvag (Joint Establishment for Nuclear Energy Research, Kjeller, Norway). Rev. Sci. Instr. 26, 397-8(1955) Apr.

A method of recording the decay of phosphorescence with a decay time longer than 2×10^{-3} sec is given. (L.T.W.)

4486

URANIUM OXIDE–YTTRIUM OXIDE SYSTEMS. F. Hund, U. Peetz, and G. Kottenhahn. Z. anorg. u. allgem. Chem. 278, 184-91(1955) Mar. (In German)

Nitrate solutions of Y and U were evaporated at 1000°C, ignited to the oxide, and radiographic investigations made. From 30.0 to 65.0 mal. % yttrium oxide appears in an imperfect fluorite phase, the lattice structure falls from 5.365 ± 0.002 kX in the corresponding reduction series to 5.306 ± 0.001 kX. The temperature relationship of specific abnormal solid solutions of three different imperfect anions is measured and the computed heat of activation of the semi-electric conductor is compared with the false system. (tr-auth)

4487

PARAMAGNETIC RESONANCE SPECTRUM OF SOME DOUBLY ACTIVATED PHOSPHORS. W. Low (Herbrew Univ., Jerusalem, Israel). Phys. Rev. 98, 426-31(1955) Apr. 15.

The paramagnetic resonance spectra of four different infrared stimulable strontium sulfide phosphors have been investigated. The hyperfine spectrum in SrS: Eu,Sm phosphor confirms the existence of divalent europium. The quantum efficiency in this phosphor is less than 1 photon per 10 europium activators. The ground state of europium is split by 0.18 cm^{-1} because of spin-orbit coupling in a cubic field. The manganese spectrum in a solid solution of strontium sulfide and selenide is discussed. (auth)

AEROSOLS

4488 BLIR-1

Chemical Corps Biological Labs., Camp Detrick, Md.
AN ANALYSIS OF THE FILTERING ACTION OF CURVED TUBES. Harold Forstat and Charles A. Boyd. Apr. 10, 1952. 17p. (ATI-171307)

The filtering action of curved tubes for the laminar flow of aerosols has been studied as a function of particle size. Theoretical equations have been derived for this action. It is found that the "cut-off" particle diameter is dependent upon the tube radius, volume rate of flow, and angle of bend, but is independent of the radius of curvature of the bend. The present all-glass impinger is analyzed on the basis of these equations and the "cut-off" value is found to be 18.4 microns. (auth)

COSMIC RADIATION

4489 AD-37128

Syracuse Univ., N. Y., Inst. of Industrial Research.
PENETRATING SHOWERS IN LIGHT AND HEAVY ELEMENTS. SCIENTIFIC REPORT NO. 2. Joseph G. Askowith and Kurt Sitte. [1954?]. 27p. Contract AF19(604)-68.

Cloud chamber measurements were made on the rate of shower production in Li, C, Al, and Pb by primary particles. The average primary energies were estimated to be between 20 and 25 Bev. By intercomparison of rates, a value of $\lambda = 2.55 \pm 0.25 \times 10^{-13}$ cm for the mean free path in nuclear matter and transparencies of 15 ± 7%, 12 ± 4%, and 6 ± 3%, respectively, for Li, C, and Al were obtained. (C.W.H.)

4490 CRT-565

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

IONISATION BURSTS DUE TO SINGLE COSMIC RAY PARTICLES. J. W. Gardner. Nov. 1954. 42p. (AECL-167)

The size-frequency distribution of ionization bursts in an 8-inch thick diam. spherical steel ion chamber containing A at 50 atm. involves three clearly separable components. This report presents a quantitative interpretation of the first of these components — the one consisting of a large number of small bursts, each comprising not more than $\sim 10^5$ ion pairs, presumably due to single particles (mesons, protons, and electrons) intersecting the chamber. Concern is made primarily with the muon, which is the chief constituent of the charged penetrating component at sea level. (L.M.T.)

4491

THE NUCLEONIC CASCADE. Juan G. Roederer. Publs. com. nacl. energia atomica (Buenos Aires), Ser. fis. 1, No. 2, 39-73(1954). (In Spanish)

The nucleonic cascade is given paying special attention to latitude effects. In the first part, the basic assumptions are discussed. In the second part, the mathematical development is given, starting from the diffusion equations and using Budini-Moière's generation spectrum. Explicit expressions are derived for the development of the nucleonic cascade, assuming either a cut-off of the primary spectrum of a pure potential form, or one of a « sectional form » as a better approximation to the real non-potential one. In the third part numerical results are given. All important features of the latitude effect of the nucleonic component as found by experiment are readily explained. Several curves are given, showing the absorptions of nucleons for different energy intervals, the variation of the absorption path with atmospheric depth and energy, the variation of the integral latitude effect for protons and neutrons as a function of energy and atmospheric depth, and the integral intensity of protons and neutrons as a function of geomagnetic latitude. (auth)

4492

THE SECOND MAXIMA IN THE TRANSITION CURVE OF COSMIC RAY SHOWERS. J. B. Harding (Atomic Energy Research Establishment, Harwell, Berks, England). Proc. Phys. Soc. (London) A68, 352-4(1955) Apr.

Apparatus similar to that of Harding (AERE-N/R-1550 (1950)) was used to investigate the second maxima in the transition curve of cosmic showers. Experimental results indicate that if care is taken to eliminate events caused by μ mesons and their associated decay electrons and if the Pb absorber is separated from the shower detecting trays by ~ 40 cm, then there is no evidence for a secondary maximum in the curve even when the apparatus is capable of detecting narrow angled (3°) showers. (L.M.T.)

4493

MEASUREMENT OF COSMIC-RAY PROTONS. C. Baccalin, P. Bassi, and C. Manduchi (Univ. of Padova, Italy). Nuovo cimento (10) 1, 657-68(1955) Apr. (In Italian)

A heavy particle selector with a Cherenkov counter in anticoincidence was used to measure the absolute intensity, the zenith angle distribution, the barometric effect, and the altitude variation of cosmic-ray protons around 400 Mev energy. The neutron-to-proton ratio was measured in the same energy region, and the inelastic nuclear interaction length in C and Pb for protons. With the exception of the neutron-proton ratio, all the results are consistent with present theoretical description of the nucleon cascade in the atmosphere. (auth)

4494

ON THE NUCLEAR INTERACTION OF He-NUCLEI IN THE COSMIC RADIATION. M. Ceccarelli, G. Quareni, and G. T. Zorn (Univ. of Padova, Italy). Nuovo cimento (10) 1, 669-78(1955) Apr. (In English)

Stars produced in photographic emulsions by the nuclear interaction of cosmic-ray He nuclei have been identified. They were selected in a systematic way, based on the identification of the tracks associated with nuclear disintegrations. These disintegrations, as well as those produced by primary protons in the same plates, were analyzed, and the angular and frequency distributions for both types of stars were determined. From a comparison of these distributions it has been concluded that, on the average, only about one-half of the nucleons of the He nucleus contribute appreciably to the destruction of the target nucleus and to the production of mesons. (auth)

4495

"KNEE" OF THE COSMIC-RAY LATITUDE CURVE. H. Victor Neher and Edward A. Stern (California Inst. of Tech., Pasadena). Phys. Rev. 98, 845-6(1955) May 1.

A phenomenon of considerable interest in the study of the distribution of cosmic-ray intensity over the earth has been the apparent absence of low-energy particles in the primary radiation. At sea level the "knee" is probably due to atmospheric absorption and has been placed at 40° to 45° geomagnetic north. At high altitudes a number of divergent results have been obtained by various observers. It is pointed out that some of this seemingly contradictory evidence may be due to the fact that the data were taken at different times. (auth)

ELECTRICAL DISCHARGE

4496

HIGH-FREQUENCY GAS DISCHARGE PLASMA IN HYDROGEN. David J. Rose (Bell Telephone Labs., Murray Hill, N. J.) and Sanborn C. Brown (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 98, 310-16(1955) Apr. 15.

The high-frequency electric field required to maintain a hydrogen plasma has been measured as a function of pressure and plasma electron density. A theory of the plasma based on a solution of the Boltzmann transport equation has been developed to predict this field; it agrees satisfactorily with experiment. The theory has no adjustable parameters, and uses only the probabilities of collision, excitation, and ionization of the gas by electrons, and the ionic mobility. (auth)

4497

AMBIPOLAR DIFFUSION IN A MAGNETIC FIELD. Albert Simon (Oak Ridge National Lab., Tenn.). Phys. Rev. 98, 317-18(1955) Apr. 15.

Diffusion of ions in a plasma across a magnetic field is shown to be not ambipolar in character in most arc experiments. Owing to the highly anisotropic conductivity of the medium, the ions diffuse across the field at their own intrinsic rate. Space-charge neutralization is maintained by slight adjustments of the currents in the direction of the magnetic field lines. The discrepancy between theory and

experiment noted by Bohm is thus resolved and no additional mechanisms, such as plasma oscillations, need be postulated. (auth)

4498

EQUILIBRIUM CHARGE DISTRIBUTION OF ENERGETIC NITROGEN IONS. H. L. Reynolds, L. D. Wyly, and A Zucker (Oak Ridge National Lab., Tenn.). Phys. Rev. 98, 474-7(1955) Apr. 15.

The equilibrium charge distribution of nitrogen ions in Formvar was measured as a function of the nitrogen energy from 6 to 26 Mev. The fringing magnetic field of the cyclotron was used to separate the charge groups resulting from the passage of the nitrogen ion beam through Formvar foils of sufficient thickness to insure an equilibrium charge distribution. Over the energy range investigated, the ionic charge is distributed primarily between four, five, six, and seven electron charges. The percentage of completely stripped ions varies from 42% at 26 Mev to 6% at 11 Mev. The ratio of the electron loss to capture cross section between N^{7+} and N^{6+} as well as between N^{6+} and N^{5+} is proportional to $V^{4.9}$, whereas between N^{5+} and N^{4+} the ratio is proportional to $V^{2.9}$. This ratio is unity for N^{6+} and N^{7+} at approximately 28.2 Mev, and for N^{5+} and N^{6+} at 13.3 Mev. (auth)

INSTRUMENTS

4499 UCRL-2946

California. Univ., Berkeley. Radiation Lab.

EDDY-CURRENT BRIDGE FOR MEASUREMENT OF SKIN LOSSES. Quentin A. Kerns. Apr. 11, 1955. 10p. Contract W-7405-eng-48.

The principle of the eddy-current bridge is to excite eddy currents in the sample surface by induction from an energized loop, and to couple out a signal proportional to loss from a second loop in close proximity to the surface. The two loops are held in a fixed relation to each other in an assembly termed the instrument head, which is placed upon the sample surface. Resistive and reactive balancing operations are then performed to obtain the skin loss. Different regions of a large sample may be successively tested, or many different samples measured, at the rate of several a minute. A frequency range of 1 kc to 100 Mc has been explored with the present instrument, and some typical loss figures for metals are tabulated. Directional conductivity effects of a few percent have been measured in machined surfaces. (auth)

4500

SOME ELECTRON-OPTICAL RESULTS OF β SPECTROMETERS OF THE KOFOED-HANSEN TYPE. Carlos Alberto Mallmann. Publs. com. nacl. energia atomica (Buenos Aires), Ser. fis. 1, No. 5, 93-9(1954). (In Spanish)

The theory of Kofoed-Hansen β-ray spectrometer is given, in which the electrons describe n loops. The motion of the electrons with respect to ϕ, is given in detail. (auth)

4501

HIGH LUMINOSITY SPECTROMETRY IN THE SOFT X-RAY REGION. I. THE CYLINDER SPECTROMETER. C. B. Van Den Berg and H. Brinkman (Natuurkundig Laboratorium der Rijks-Universiteit, Groningen, Netherlands). Physica 21, 85-102(1955) Feb. (In English)

A new kind of high-luminosity focusing x-ray spectrometer is described in which the crystal is bent in the shape of a cylinder and the spectra are observed along the cylinder axis. This instrument shows a high luminosity and a high resolving power. The line-shaped x-ray source is efficiently used; the spectral lines are stigmatic images of the line focus. The wavelength dispersion is nearly constant. The characteristics of the spectrometer are calculated. A spectrometer with a cylindrical mica crystal with radius of curvature $\rho = 200$ mm and reflecting surface of 14×4 cm^2 was built and proved to be very reliable. The intensity gain over known x-ray spectrometers is calculated and proved to be as large as 60 to 90, for large glancing angles φ, not accounting for the fact that a much larger wavelength region (about 500 XU) can be covered in one exposure. Wavelength dispersion 16 XU/mm. The adjustment is done optically. The spectrometer for wavelengths from 9 to 19 A is enclosed in a steel tank that can be evacuated. A typical spectrum is shown. The instrument can also be used as a stigmatic point focusing monochromator. (auth)

4502

TOLANSKY GAUGE FOR RAPID MEASUREMENT OF FILM THICKNESS. T. M. Green and L. N. Hadley (Dartmouth Coll., Hanover, N. H.). J. Opt. Soc. Amer. 45, 228-9(1955) Mar.

The thickness of a thin film can be determined rapidly with an accuracy of 50A by a device utilizing the Tolansky interference method. Based on the displacement obtained when light passes through a plane sheet of glass at oblique incidence, the instrument enables fringe shift and spacing to be determined at a single observation. The film thickness can then be readily calculated. (M.P.G.)

4503

TUNGSTEN LAMP SOURCE SUITABLE FOR PRODUCING FLASH BURNS. Thomas P. Davis, Leo J. Krolak, and Joseph A. Basso (Univ. of Rochester School of Medicine and Dentistry, Rochester, N. Y.). J. Opt. Soc. Amer. 45, 397-8(1955) May.

ISOTOPES

4504 ORNL-1861

Oak Ridge National Lab., Tenn.

RADIOISOTOPE PRODUCTION AND PROCESS DEVELOPMENT. ANNUAL REPORT FOR 1954. A. F. Rupp, [comp.]. May 19, 1955. 10p. Contract W-7405-eng-26.

Production and process development activities during the calendar year 1954 are summarized. Twelve thousand five hundred and eighty-five shipments were made. The quantity of activity shipped increased from 10,587 c in 1953 to 28,879 c in 1954. Large Co^{60} and Ir^{192} sources accounted for most of the increase in activity. The separation and concentration of the main classes of long-lived radioisotopes found in process wastes were demonstrated on a semiworks scale, and the construction of a proposed pilot plant to produce kilocurie sources of certain long-lived fission products from process wastes is discussed. A multikilocurie loading cell for handling Co^{60} is described. (C.H.)

ISOTOPE SEPARATION

4505

THE ENRICHMENT OF RADIO-ACTIVE ISOTOPES BY THERMAL DIFFUSION. A. E. De Vries. Physica 21, 124-6(1955) Feb. (In English).

A method is suggested to enhance the enrichment of a

radioactive isotope in a thermal-diffusion column. The method is of importance when the quantity which has to be enriched is small compared to the hold-up of the column. In this case a longer column would not give a better enrichment. As an example CO is chosen in which the CO^{14} has to be concentrated in a small amount of CO^{12}. (auth)

MASS SPECTROGRAPHY

4506

NEW TIME-OF-FLIGHT MASS SPECTROMETER. Henry S. Katzenstein and Stephen S. Friedland (Univ. of Connecticut, Storrs). Rev. Sci. Instr. 26, 324-7(1955) Apr.

A time-of-flight mass spectrometer based on principles previously described has been constructed with two major modifications to facilitate appearance potential measurements. These modifications are (1) an axial electron beam is pulsed through an ionization chamber utilizing techniques of Fox, et al., and (2) a gated ion detector is employed to allow for integration of the resolved ion current from successive cycles. The instrument has been constructed of stainless steel to allow for measurements on chemically active gases. Theoretical resolution, limited by thermal energies of the ions, appears to be well over mass 200. Preliminary experimental work has verified this up to the region of mass 100. Ionization potentials, using the difference method, have been obtained from various gases that are in agreement with the spectroscopic data to within 0.05 volts. (auth)

MATHEMATICS

4507 LA-1891

Los Alamos Scientific Lab., N. Mex

SOLUTION OF THE TRANSPORT EQUATION BY S_N APPROXIMATIONS. Bengt G. Carlson. Feb. 1955. 28p. Contract W-7405-eng-36.

A numerical method for solving diffusion problems in plane, spherical, and cylindrical geometries is developed. Specifically, it applies to the integro-differential equation of Boltzman, known in neutron diffusion work as the transport equation. Solutions are obtained in the spherical case for the stationary as well as the time-dependent form of the equation. Moreover, it is shown that problems in plane and cylindrical geometries may be identified with problems relating to spheres. (auth)

4508 ORNL-1883

Oak Ridge National Lab., Tenn.

ON THE CONVERGENCE OF MATRIX ITERATIONS. Alston S. Householder. May 18, 1955. 47p. Contract W-7405-eng-26.

4509 UCRL-4476

California. Univ., Livermore. Radiation Lab.

INSTABILITY CONSIDERATIONS FOR VARIOUS DIFFERENCE EQUATIONS DERIVED FROM THE DIFFUSION EQUATION. G. W. Evans, R. J. Brousseau, and R. Keirstead. Oct. 1954. 36p. Contract W-7405-eng-48.

This paper is concerned with instability analysis of various difference equations whose solutions represent the solution of $\alpha\Delta^2 u(\vec{x},t) = u_t(\vec{x},t)$ where α is positive under stated initial and boundry conditions. The difference equations are considered from the aspect of high-speed digital computing machines and from the aspect of handling problems in which there are many space mesh points over a time duration of solution as large as possible. Thus, the methods of interest are those in which the difference equations are not unconditionally unstable with respect to Δx and Δt and are preferably not conditionally unstable with respect to these quantities. To avoid the necessity of inverting large order matrices, stable iterative schemes are proposed and examples of their use are given. (auth)

MEASURING INSTRUMENTS AND TECHNIQUES

4510 AERE-HP/M-83

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A RADON-IN-AIR MONITOR FOR USE IN MINES. L. W. D. Pittendrigh. Dec. 7, 1954. 16p.

The monitor described was developed to provide a means of giving almost instantaneous detection of radon in air during mining operations below ground. It is battery operated and entirely self-contained. A volume of one liter of air is continuously monitored by an arrangement of twin phosphors and photomultipliers. Counting rates of 4 and 40 counts per second are provided, and with an overall efficiency of 50%, this gives ranges of 2×10^{-10} curie/liter. Audible indication is either by loud speaker or by headphones. (auth)

4511 AERE-I/M-34

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

IONIZATION CHAMBER MEASUREMENTS WITH TRITIUM. E. J. Wilson. Nov. 3, 1954. 15p.

A series of tests with varying concentrations of tritium in hydrogen and at varying pressures indicate the versatility of an ionization chamber, spherical in shape, of 200 cc capacity, constructed of pyrex glass and using burnished silver coated internally as the electrodes. (auth)

4512 AERE-NP/M-73

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE USE OF A LITHIUM IODIDE DETECTOR WITH A NEUTRON CRYSTAL SPECTROMETER. K. P. Nicholson and N. J. Pattenden. Jan. 11, 1955. 12p.

The counting and background rates of a lithium iodide scintillation detector and a boron trifluoride proportional counter are compared when used as detectors for a neutron crystal spectrometer. The counts to background ratio of the scintillator is found to be considerably less than that of the proportional counter. The efficiency of the crystal, relative to the proportional counter, is compared with theoretical values. (auth)

4513 CERN-BS-20

European Organization for Nuclear Research, Geneva.

APPARATUS FOR MAKING GAP-LENGTH MEASUREMENTS IN NUCLEAR EMULSIONS. H. M. Mayer. May 10, 1955. 6p.

A device is described which semiautomatically determines the mean gap length in particle tracks in nuclear emulsions. A microscope stage is driven by a small motor, and the displacement of the stage is registered by a counter. The length of a gap is measured by pressing a button at the beginning of the gap and releasing it at the end. A second counter registers the total gap length, and a third counter registers the number of gaps measured. A

binary scaler may be used to compile information from the counters. (M.P.G.)

4514 KAPL-1312

Knolls Atomic Power Lab., Schenectady, N. Y.
SOME STATISTICAL ASPECTS OF X-RAY FLUORESCENCE SPECTROMETRY. W. S. Horton. Apr. 19, 1955. 21p. Contract W-31-109-Eng-52.

A simple derivation of the probability distribution function for the time to accumulate a preset number of counts is outlined. The result is applied to x-ray fluorescence spectrometry in order to estimate the expected precision of the various measures of quantity of an element. Examples are given to show how the results may be used as a practical guide in this field of analytical chemistry. (auth)

4515 NP-5625

Massachusetts Inst. of Tech. Cambridge. Servomechanisms Lab.
A STACKED-DISK NEUTRON THERMOPILE. TECHNICAL REPORT NO. 5. Frank S. Replogle, Jr. Mar. 15, 1955. (Includes appendix: A Study of Spurious Responses of a Neutron Thermopile. Cyrus O. Harbourt). 132p. Contract N5ori-07877.

The stacked-disk type slow neutron thermopile described was designed to indicate flux levels from a minimum of 10^{12} neutrons/cm^2/sec down as many decades as possible in a short period of time. Problems involved in fabrication of the thermopile are discussed and assembly of single and multi-element disk-type thermocouples are described. The completed unit was subjected to electrical bench tests and the neutron flux of the Brookhaven nuclear reactor. The stacked-disk thermopile showed promise in its fast response, in the range of response times achievable with the basic design, and in its power sensitivity and in its mechanical strength. Results from a study of spurious responses of a neutron thermopile are appended. (C.H.)

4516 NP-5630

Canada. Dept. of Mines and Technical Surveys.
A NEW ASSAY UNIT FOR BAGGED RADIOACTIVE ORE. A. H. Bettens and G. G. Eichholz. Feb. 25, 1955. 11p. (TR-127/55)

A new radiometric assay unit is described for use on bagged coarse uranium ore. This unit was designed specifically for use at northern mine locations where very low temperatures may be encountered. Detection is by two scintillation heads, each incorporating a plastic scintillator, a 6292 photomultiplier tube, and a two-stage preamplifier. Indication is by means of a commercial ratemeter. Sensitivity is comparable to that of an earlier model. Practical operating details are discussed. (auth)

4517 UCRL-2928

California. Univ., Berkeley. Radiation Lab.
METHOD FOR ALIGNMENT OF STRIPPED NUCLEAR EMULSIONS. Gerson Goldhaber, Stephen J. Goldsack, and Joseph E. Lannutti. Mar. 23, 1955. 11p. Contract W-7405-eng-48.

A method is described for aligning stacks of nuclear emulsions by punching matching sets of holes in them and then using these holes as guides in assembling the stacks, in photographing reference grids on the individual emulsions, and in attaching reference edges to the plates on which the emulsions are mounted. (auth)

4518 TT-530

A CASE OF AGING IN SCINTILLATION LIQUIDS. (Un Caso D'Invecchiamento Di Scintillatori Liquidi). M. Ageno, G. Cortellessa, and R. Querzoli. Translated by D. A. Sinclair from Nuovo cimento (9), 9, 1242-3(1952). 3p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 7-2065.

4519 TT-531

ON THE MECHANISM OF SCINTILLATION IN SOLUTIONS. (Sul Meccanismo Delle Scintillazioni Nelle Soluzioni). M. Ageno and R. Querzoli. Translated by D. A. Sinclair from Nuovo cimento (9), 9, 282-90(1952). 14p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 6-4749.

4520

FAST COINCIDENCE AND γ-γ SPECTROSCOPY WITH A INa(TL) SCINTILLATION COUNTER. APPLICATION TO Rh^{102}. Louis Dick, Roger Foucher, Nils Perrin, and Hamlet Vartapetian. Compt. rend. 240, 1335-7(1955) Mar. 21. (In French)

An instrument suitable for α-γ coincidence measurements and γ-γ spectroscopy is described. Resolution time of the system can be varied from 5×10^{-9} to 2×10^{-8} sec. Application to the γ spectrum of Th^{102} revealed two new lines at 125 and 195 kev. (K.S.)

4521

ANOMALIES IN THE DIFFUSION OF RADON IN "DRY" PHOTOGRAPHIC GELS. POSSIBLE EXISTENCE OF TWO STATES OF GELATIN. Leopold Vigneron, Jeannine Genin, and Raymond Chastel. Compt. rend. 240, 1423-5(1955) Mar. 28. (In French)

Measurements of the diffusion of Rn in Ilford C_2 emulsions (100 μ) show that wide fluctuations in the diffusion coefficient occur after drying for 1 hr in air and inserting the plate in a box containing K. An explanation of the anomalies is proposed on the basis of postulating an α-β transformation in the structure of the gelatin. (K.S.)

4522

AUTOMATIC ISODOSE RECORDER. M. Berman, J. Laughlin, M. Yonemitsu, and S. Vacirco (Sloan-Kettering Inst., New York). Rev. Sci. Instr. 26, 328-33(1955) Apr.

An apparatus is described which compares the signals developed by two detectors. An application is the measurement and plotting of the distribution of radiation energy produced by x-ray generators. Measurement of the radiation energy is made with ionization chambers or scintillation counters as detectors, the signals of which are amplified with dc amplifiers. The noise level of the amplifiers is equivalent to a current of about 5×10^{-15} amperes when used with an input resistor of 10^{11} ohms. The ratio of the outputs of the two detectors is obtained directly, using a servo system which compares a fraction of the larger signal with the smaller one. The accuracy and reproducibility of the balancing circuit is better than 0.2 percent. The minimum detectable signal is less than 0.1 millivolt. The same servo system is also employed to control the motion in space of one of the detectors (a probe) so as to seek a position such that its signal is any preselected portion of the other detector's (monitor) signal. Thus, a path of constant energy is traversed by driving the probe perpendicularly to the direction of the x-ray beam and controlling the position parallel to the beam through the servo system. The trace of the path of the probe is simultaneously duplicated and recorded on a chart. The mechanical reproducibility of the detector position and plotting mechanism in any direction is better

than one millimeter. The application of the apparatus for the automatic determination and recording of isodose contours produced in water by the absorption of x-ray beams of widely different energies is outlined. (auth)

4523

SOME CHARACTERISTICS OF CHLORINE QUENCHED GEIGER-MUELLER COUNTERS. A. L. Ward and A. D. Krumbein (Univ. of Maryland, College Park). Rev. Sci. Instr. 26, 341-51(1955) Apr.

Extensive studies have been made of the starting potentials and plateau characteristics of chlorine-quenched neon and argon counters with titanium and zirconium metal cathodes, using a previously described optical absorption method to measure the concentration of the halogen in the presence of the rare gases. An equation of the type first formulated by Lauterjung for the starting potentials of organic-quenched counters, has been found to hold for chlorine-quenched counters. The constants in the equation have been determined for the counter fillings and cathodes used. A nomograph has been drawn which enables the starting potentials of neon-chlorine counters to be determined for various counter dimensions, total gas pressures and percentage of chlorine. From the deviations of the experimental data from straight lines at high E/p, an estimate has been made of the behavior of α/p (α is Townsend's first coefficient), for neon and argon at higher E/p values than those which are given in the literature. The consideration of secondary Townsend processes gives a new interpretation of the Lauterjung constants. The plateau length of counters filled to a constant total pressure was found to increase linearly with an increase in chlorine concentration. Plateau slopes have been found to decrease initially with increasing chlorine concentration, then to remain constant. Normally, it has been found to be of no advantage to add argon to a neon-chlorine counter. (auth)

4524

ABSORPTION AND COUNTING-EFFICIENCY DATA FOR X-RAY DETECTORS. Jeanne Taylor and William Parrish (Philips Labs., Irvington-on-Hudson, N. Y.). Rev. Sci. Instr. 26, 367-73(1955) Apr.

Mass absorption coefficient data published by Allen, Bragg, and Victoreen for the wavelength region 0.1 to 50 A are plotted for several common x-ray tube and counter windows (Al, Be, and mica) and gases (Xe, Kr, A, and Ne) used in x-ray detectors. A graph of the calculated percentage transmission of the windows is presented. The calculated quantum-counting efficiencies for the range 0.1 to 15 A are shown for an end-window argon-filled Geiger counter, side-window Xe, Kr, A, and Ne proportional counters, and an NaI·Tl scintillation counter. Some of the factors to be considered in the choice of detectors for x-ray diffractometry and x-ray spectroscopy are discussed particularly with respect to the spectral sensitivity. (auth)

4525

X-RAY DIFFRACTOMETRY OF RADIOACTIVE SAMPLES. T. R. Kohler and William Parrish (Philips Labs., Irvington-on-Hudson, N. Y.). Rev. Sci. Instr. 26, 374-9(1955) Apr.

Geiger counter x-ray diffractometer patterns of samples with moderate to high radioactivity give a high background, which reduces the precision of the x-ray-line intensity and profile measurements. The large amount of lead shielding required to reduce the background is not practical in modern precision goniometers and could not bring as great a reduction as can be achieved with scintillation or proportional counters using pulse-height discrimination and no shielding. This paper describes a technique using a scintillation counter which permits the measurement of x-ray patterns from strongly radioactive specimens. A scintillation counter with 0.56 in. × 0.16 in. × 0.017 in. thick NaI·Tl crystal, 0.005 in. Be window, and DuMont 6291 photomultiplier is described, which reduced the background of an 84 mr/hr/10 cm Co^{60} sample from 785 c/sec, measured with a Geiger counter, to 26 c/sec and increased the sensitivity to CuKα by a factor of about 2.5 to 3. (auth)

4526

APPLICATION OF COINCIDENCE METHODS TO THE STUDY OF β DISINTEGRATION SCHEMES. Carlos Alberto Mallmann. Publs. com. nacl. energia atomica (Buenos Aires), Ser. fis. 1, No. 1, 1-35(1953). (In Spanish)

The possibilities of the coincidence method using coincidence β-ray spectrometers for the investigation of disintegration schemes of β emitters are given. It is proved that the experimental set up must fulfill the following conditions: A) The coincidence β-ray spectrometers must have (a) independent energy measurement in the counter-spectrometer system, (b) large gathering power and good resolving power in the counter-spectrometer system, (c) the ability of reducing to a negligible value with absorbing materials, the counts produced by γ rays, (d) an optimum location of the counters to make negligible the cosmic-ray coincidence counts, (e) the counter outside of the magnetic field, and (f) the possibility of observing angular correlations. B) The coincidence equipment must have resolving time as small as possible. C) The radioactive specimen must have optimum intensity. (auth)

4527

DISINTEGRATION-RATE DETERMINATION BY 4π-COUNTING. PART II. SOURCE-MOUNT ABSORPTION CORRECTION. B. D. Pate and L. Yaffe (McGill Univ., Montreal, Quebec, Canada). Can. J. Chem. 33, 929-37(1955) May.

An "absorption curve" type method is proposed for the determination of the correction for absorption due to the source mount used in 4π-counting. (C.W.H.)

4528

PREPARING LARGE-AREA PLASTIC SCINTILLATORS. Joachim Fischer (Institute for Nuclear Studies, Chicago). Nucleonics 13, No. 5, 52-4(1955) May.

A method is described for the preparation of large-volume clear plastic scintillators free from apparent strains and without size limitations. (C.H.)

4529

COUNTING TECHNIQUES FOR CHLORINE-36. Milton Kahn, Arthur J. Freedman, Robert D. Feltham, and Neil L. Lark (Univ. of New Mexico, Albuquerque). Nucleonics 13, No. 5, 58-60(1955) May.

Both mercurous and silver chlorides were found to be suitable precipitates for use in the preparation of samples containing Cl^{36} for radiometric analysis. The counting efficiency of three dip counters was determined and found to be satisfactory for counting solutions containing Cl^{36}. Equipment and procedures are described. (C.H.)

4530

U^{235} NEUTRON THERMOPILE PROVIDES GREATER SENSITIVITY. T. Richard Herold (E. I. du Pont de

Nemours and Co., Inc., Augusta, Ga.). Nucleonics 13, No. 5, 64-6(1955) May.

A uranium^{235} thermopile is described which retains the characteristics of low impedance, compactness, and simple construction. The thermopile provides linear measurements of neutron fluxes from below 5×10^7 nv to above 5×10^{11} nv. Stacked units can easily reduce the lower limit to 5×10^6 nv, suggesting applications in the period range of nuclear reactors. (C.H.)

4531

FOLLOWING SURFACE DIFFUSION OF RADIOISOTOPES. N. H. Simpson and Norman Hackerman (Univ. of Texas, Austin), Nucleonics 13, No. 5, 67-8(1955) May.

A scintillation counter with an anthracene crystal and a DuMont 6292 photomultiplier tube gave good performance in following the concentration of Cu^{64} at various sites on the surface of a single Cu crystal. It is suggested that the method may offer a satisfactory procedure for studying movement of radioactive atoms over a surface. (C.H.)

4532

CONTRIBUTION TO THE METHODOLOGICAL STUDY OF PHOTOGRAPHIC EMULSIONS USED IN NUCLEAR PHYSICS. Jean-Pierre Lonchamp. Ann. phys. 10, 201-58 (1955) Mar.-Apr. (In French)

4533

INFLUENCE OF THE DISTANCE BETWEEN SOURCE AND CRYSTAL ON THE DETECTION-EFFICIENCY OF A GAMMA-SCINTILLATION SPECTROMETER. L. H. Th. Rietjens, G. J. Arkenbout, G. F. Wolters, and J. C. Kluyver (Physisch Laboratorium der Rijksuniversiteit te Utrecht, Netherlands). Physica 21, 110-16(1955) Feb. (In English)

The influence of the distance between source and crystal on the counting efficiency of a scintillation spectrometer has been studied. For gamma rays of energy larger than 400 kev the efficiency may vary by a factor of two depending on the distance from source to crystal. The experimentally observed dependence may be fully explained by simple geometrical arguments. (auth)

4534

THE PULSE HEIGHT DISTRIBUTION FROM A SODIUM IODIDE SINGLE CRYSTAL SCINTILLATION COUNTER AND THE MEASUREMENT OF GAMMA RAY FLUXES. G. M. Griffiths (Univ. of British Columbia, Vancouver). Can. J. Phys. 33, 209-18(1955) May.

The theory of the interaction of γ rays with a single crystal of sodium iodide is described and a comparison made between the pulse height distributions, calculated on the basis of primary interactions only, together with the broadening due to the statistics of light production and electron multiplication, and the experimentally measured distributions. The differences are qualitatively accounted for on the basis of secondary interactions, bremsstrahlung, and wall effects. The absolute efficiency of a scintillation counter, calculated from the size and volume and energy corresponding to the bias level of the counting system, has been used to compute the intensity of γ radiation from a standardized source of Co^{60} and from the reaction $Li^7(p,\gamma)Be^8$, the yield of which was known from previous work. Good agreement was obtained after allowance was made, experimentally, for the secondary interactions. (auth)

4535

THE PULSE HEIGHT DISTRIBUTION FROM BORON TRIFLUORIDE PROPORTIONAL COUNTERS IRRADIATED WITH 4.87-MEV NEUTRONS. D. B. James, W. Kubelka, S. A. Heiberg, and J. B. Warren (Univ. of British Columbia, Vancouver). Can. J. Phys. 33, 219-24(1955) May.

Two boron trifluoride proportional counters, one containing normal isotopic B and the other containing B enriched to 96% B^{10}, have been irradiated with 4.87-Mev neutrons from the reaction $D(d, n)He^3$. In addition to the reactions $B^{10}(n, \alpha)Li^7$ and $B^{10}(n, \alpha)Li^{7*}$ with Q values of 2.79 Mev and 2.31 Mev respectively, two other reactions have been observed. These are (i) $F^{19}(n, \alpha)N^{16*}$ with a Q value of -1.77 ± 0.15 Mev and (ii) either $B^{10}(n, p)Be^{10}$ or, much more probably, $B^{10}(n, t)Be^8$ with a Q value of 0.35 ± 0.20 Mev. Owing to the presence of these two reactions, the analysis of complex fast-neutron spectra by the use of such counters is not feasible. (auth)

4536

NEW METHOD FOR MEASURING THE α-PARTICLE RANGE AND STRAGGLING IN LIQUIDS. Gunnar Aniansson (Royal Inst. of Tech., Stockholm). Phys. Rev. 98, 300-2(1955) Apr. 15.

The ranges of Po α particles in water and five other liquids have been measured with a new method involving a steel surface as support for the α source and a $CaWO_4$ crystal surface as detector for the α particles. The surfaces are optically plane and parallel and constitute the walls of a microcell for the liquid. The range obtained at 25°C in water was 39.8 μ 2.7% longer than the value 38.8 μ, computed with the Bragg law from range measurements in gaseous hydrogen and oxygen. In the other five liquids the ranges obtained also were longer (2.3–4.6%) than the correspondingly computed Bragg law values. (auth)

4537

MECHANISM OF THE TERMINATION OF THE GEIGER PLATEAU REGION. H. L. Wiser and A. D. Krumbein (Univ. of Maryland, College Park). Phys. Rev. 98, 303-10(1955) Apr. 15.

The mechanisms responsible for the termination of the Geiger counter plateau region at its high-voltage end were investigated by a direct experimental method. Geiger counters were operated in a normal manner and counting rate vs. voltage and number of positive ions per pulse vs. voltage were measured in the breakdown region. Analysis of the data indicated that spurious counts could result from two phenomena: (1) secondary electrons created by positive-ion bombardment of the cathode; and (2) metastable atom and molecule decay in the gas. The rate of spurious counts caused by positive-ion bombardment was found to be proportional to the rate of positive ions striking the cathode and, therefore, proportional to the voltage. This accounted for the plateau slope, if present, and the slight increase in slope at the beginning of the breakdown region. It is shown that the exponential rise in counting rate in the breakdown region can be explained by the decay of metastable atoms and molecules that exist after the deadtime of the primary pulses. Experimental results indicate that metastable atoms were dominantly responsible for spurious counts at low pressures (about 40 mm Hg) and metastable molecules at high pressures (200 mm Hg). (auth)

4538

POSSIBILITY OF A NUCLEAR RADIATION DETECTOR BY MEANS OF ELECTROLUMINESCENT PHOSPHORS.

W Low (Hebrew Univ., Jerusalem, Israel). Phys. Rev. 98, 556(1955) Apr. 15.

This note points out that the light output of scintillation counters which use electroluminescent phosphors could possibly be increased by subjecting the phosphor to strong electric fields. (L.M.T.)

MESONS

4539 CERN-BS-19

European Organization for Nuclear Research, Geneva. DECAY OF A HYPERON IN FLIGHT. N. Solntseff. May 10, 1955. 3p.

An event which can be interpreted as a decay of a hyperon in flight has been observed in a stripped emulsion stack exposed at 70,000 ft. The particle was ejected from a star in the emulsion. Data on the primary and secondary particles are presented. (M.P.G.)

4540

NUCLEAR INTERACTION OF K MESONS. A. Husain and E. Pickup (National Research Council, Ottawa, Canada). Can. J. Phys. 33, 260-3(1955) May.

K mesons have been identified in nuclear emulsions exposed in a balloon flight at 95,000 ft. Some interesting features of the K-meson tracks are discussed. It is noted that the K mesons were of relatively low energies although they came from low energy stars. The variation of $p\beta$ with ionization is plotted for π and K mesons, protons, and deuterons. (M.P.G.)

4541

THE INTERACTION OF FAST K-MESONS. M. W. Friedlander, D. Keefe, and M. G. K. Menon (Univ. of Bristol, England). Nuovo cimento (10) 1, 694-704(1955) Apr. (In English)

Two events are described in which heavy mesons interact with nuclei in photographic emulsions, producing small stars and emerging themselves from the collisions. In one example, a relativistic singly charged particle enters the stack and produces a star with only three emergent charged particles, which have been identified as a hyperon, a π meson, and a K meson, respectively. The K meson creates two stars before it comes to rest and decays with the emission of a slow μ meson. In the other example, a K meson enters the stack from outside and, after interacting, comes to rest within the emulsion and decays with the emission of a single lightly ionizing particle. Certain features of interest associated with the scattering properties of heavy mesons are discussed. (auth)

4542

A SEARCH FOR ANGULAR CORRELATIONS IN τ-MESON DECAY. M. Teucher, W. Thirring, and H. Winzeler. Nuovo cimento (10) 1, 733-4(1955) Apr. (In English)

4543

EXAMPLE OF A PROBABLE Λ_0 PARTICLE OF HIGH ENERGY. A. De Marco, A. Milone, and M. Reinharz (Univ. of Genova, Italy). Nuovo cimento (10) 1, 744-5 (1955) Apr. (In Italian)

A 4700-μ track in a G5 emulsion was found in a plate exposed at 24,000m. Analysis of the track indicates that it was caused by a Λ_0 particle of 5 ± 1 bev. (K.S.)

4544

EFFECT OF THE ANAMALOUS NUCLEON MAGNETIC MOMENT ON THE π^0 LIFETIME. Stanley Cohen (Institute for Nuclear Studies, Chicago). Phys. Rev. 98, 749-50(1955) May 1.

The anomalous magnetic moment of the intermediate nucleons has been included in a treatment of the two-photon decay of the π^0. It is found that this inclusion leads to a shorter, rather than a longer, lifetime, thereby failing to reduce the discrepancy between the experimental and previous theoretical values. (auth)

4545

PION PRODUCTION BY ELECTRONS. W. K. H. Panofsky, C. M. Newton, and G. B. Yodh (Stanford Univ., Calif.). Phys. Rev. 98, 751-5(1955) May 1.

The production of π^+ mesons directly by 500-Mev electrons has been studied in lithium. The measurements consist of a precise measurement of the ratio of electron-produced to bremsstrahlung-produced pion yields. Results expressed as "equivalent radiation length" X_e for electron production are $X_e = 0.0233 \pm 0.0012$ for pions of 55 Mev, and 0.0185 ± 0.0014 for pions of 150 Mev at 75° to the incident electron beam. The results are fully compatible with purely electromagnetic interaction of the electrons. Within the limitations of the experimental data obtained to date, and of the available theoretical studies, the results are compatible with magnetic-dipole absorption as the predominant process in photopion production under the conditions indicated. (auth)

4546

EXAMPLE OF THE CASCADE DECAY OF A NEGATIVE HYPERON. W. H. Arnold, J. Ballam, G. K. Linderberg, and V. A. J. Van Lint (Princeton Univ., N. J.). Phys. Rev. 98, 838(1955) May 1.

An example of the cascade-type decay of a negatively charged hyperon has been found in a magnetic field cloud chamber operated at Echo Lake, Colorado. Track 1 is unmeasurable both as to momentum and sign. It decays into a slow-moving light meson, track 2. A V° particle (tracks 3 and 4) is seen to decay at a point 1.1 cm from the hyperon decay point. All four tracks are ionizing at less than twice minimum. The pertinent measurements on this event are given. (auth)

4547

REMARKS ON THE EXCITED STATES OF SHORT AVERAGE LIFE AND THE PRODUCTION OF MESONS. Bernard d'Espagnat and Jacques Prentki. Compt. rend. 240, 1514-16(1955) Apr. 4. (In French)

This note concerns the models for meson production that are applicable to an intermediate excited nucleon of short half life. The application of the methods is discussed in relation to the average life of the excited state. (tr-auth)

4548

HIGH-ENERGY NUCLEAR PHYSICS. Bernard T. Feld (Massachusetts Inst. of Tech., Cambridge). Nucleonics 13, No. 5, 34-7(1955) May.

Results of recent field-theoretic investigations on the structure of elementary particles, heavy mesons and hyperons, pion-nucleon interactions, and mesic atoms are reported. (C.H.)

4549

FURTHER EVIDENCE FOR THE ELECTRON-DECAY OF K-MESONS. R. H. W. Johnston and C. O'Ceallaigh (Dublin Inst. for Advanced Studies, Ireland). Phil. Mag. (7) 46, 393-400(1955) Apr.

An event is described in which a K meson decays at

rest to a particle at plateau ionization which has the properties of an electron of $p\beta c \sim 80$ mev. This brings to three the number of K mesons in which the charged decay product is apparently an electron. (auth)

NUCLEAR PHYSICS

4550

ON THE INTERPRETATION OF FISSION ASYMMETRY ACCORDING TO THE LIQUID DROP NUCLEAR MODEL. U. L. Businaro (Laboratori CISE, Milan, Italy). Nuovo cimento (10) 1, 629-43(1955) Apr. (In English)

The possibility is examined, on the liquid drop model, that the asymmetrization in the low-energy nuclear fission may take place after the system, in evolving along its reaction path, has passed the symmetric saddle. The energy surface is investigated beyond the symmetric saddles both by extrapolating well known formulas, valid in the small deformation range, and by using a representation in which the energy of shapes slightly different from an arbitrarily prolated basic ellipsoid may be calculated. The results obtained seem to indicate that along the effective symmetric reaction path there exists an inversion point, beyond which, in the case of incipient motion a small asymmetric deformation would tend to grow. (auth)

4551

GIANT RESONANCE INTERPRETATION OF THE NUCLEON-NUCLEUS INTERACTION. A. M. Lane (Massachusetts Inst. of Tech., Cambridge), R. G. Thomas (Los Alamos Scientific Lab., N. Mex.) and E. P. Wigner (Princeton Univ., New Jersey). Phys. Rev. 98, 693-701 (1955) May 1.

In the consideration of the independent-particle model, a distinction can be made between the spacing D of the levels of the whole nucleus and the spacing d of the levels of individual nucleons. Except in the immediate neighborhood of the normal state of closed-shell nuclei, $d \gg D$. In the "giant-resonance" interpretation considered here, the deviations from the independent-particle model are strong enough to mix many states of the whole nucleus, but the mixing is restricted to an energy range which is less than the order of d. According to this interpretation, the reduced particle widths of the levels of the compound nucleus are, on the average, anomalously large close to the energy values of those states of the independent-particle model which correspond to an unexcited target nucleus and a virtual level of the incident particle. As a consequence, the nuclear cross sections have a gross structure which is similar to a giant resonance, such as is implied by the complex square well representation of the nucleon-nucleus interaction. The position, width, and height of these maxima in the average cross sections are expressed in terms of the parameters of the independent-particle model and the departure of the actual nuclear potential which are responsible for the inaccuracy of this model. It is shown, however, that the conventional nuclear potential gives far too large values for the widths of the giant resonances (that is, for the imaginary part of the presentative complex square well potential). (auth)

4552

INTERNAL CONVERSION IN THE L AND M SUBSHELLS. E. L. Church and J. E. Monahan (Argonne National Lab., Lemont, Ill.). Phys. Rev. 98, 718-23(1955) May 1.

The relative internal conversion of electric and magnetic transitions in the L and M subshells has been calculated nonrelativistically with neglect of screening. In the approximations employed, the relative conversion coefficients are functions of the parameter $Z^2/\hbar\omega$, where Z is the atomic number, and $\hbar\omega$ the nuclear transition energy. For the L shell, these quantities have been evaluated over the entire range of practical interest, while for simplicity, the M shell has been considered only for vanishing electron momentum. Results are given for transitions of multipole order 1 through 5. Comparison with existing relativistic calculations and experimental data indicates the essential validity of the results obtained, and allows semiempirical generalizations to be made. It is found that dipole transitions, especially magnetic, convert strongly in the S subshells. With increasing multipole order, subshells of successively higher orbital angular momenta are preferred. Electric transitions exhibit comparable conversion in the relativistic doublets, $j = l \pm \frac{1}{2}$, while magnetic transitions convert almost entirely in the $j = l + \frac{1}{2}$ component. The usefulness of these properties in the identification of the character of low-energy transitions in heavy elements is indicated. (auth)

4553

(p,a) AND (p,ab) REACTIONS AT 100 MEV. J. W. Meadows (Harvard Univ., Cambridge, Mass.). Phys. Rev. 98, 744-9(1955) May 1.

Nuclear reactions at energies of the order of 100 Mev and higher are considered as being divided into two independent steps, a knock-on process followed by nucleon evaporation. The effect of the knock-on process is evaluated by a method similar to that of Goldberger, while the evaporation process is treated in the usual way. Cross sections for several (p,n), (p,2n), (p,pn), and (p,2p) reactions on intermediate nuclei are calculated and compared with experimental results. (auth)

4554

ENERGY LEVELS OF π-MESONIC ATOMS. K. A. Brueckner (Indiana Univ., Bloomington). Phys. Rev. 98, 769-71(1955) May 1.

The shift of the energy levels of the π-mesonic atom which results from the strong nuclear absorption of the meson is estimated and shown to be comparable with the shift associated with the scattering interaction. It is also shown that the level broadening due to the finite lifetime of the meson in the nucleus is almost entirely produced by the absorption process. (auth)

NUCLEAR PROPERTIES

4555

NUCLEAR ELECTRIC QUADRUPOLE MOMENT OF Na^{23} BY THE ATOMIC BEAM RESONANCE METHOD. M. L. Perl, I. I. Rabi, and B. Senitzky (Columbia Univ., New York). Phys. Rev. 98, 611-26(1955) May 1.

The hyperfine structure of the $n = 3^2P_{\frac{1}{2}}$ and $^2P_{\frac{3}{2}}$ excited atomic states of Na^{23} have been investigated using a modification of the atomic beam resonance method. The C region is illuminated with resonance radiation from a sodium discharge lamp which brings some of the atoms into the excited levels where they have lifetimes of the order of 10^{-8} sec. The application of an r-f field of an appropriate frequency causes transitions among the excited state hyperfine levels and "scrambles" the

populations of these levels. Since the atoms are essentially "tagged" by the deflection which they have undergone in the A field, this "scrambling" will cause a change in the refocused intensity at the detector. Measurements of the hyperfine structure at weak fields give the values: $\alpha_{1/2} = 94.45 \pm 0.5$ Mc/sec for the $3^2P_{1/2}$ state; $\alpha_{3/2} = 19.06 \pm 0.36$ Mc/sec for the $3^2P_{3/2}$ state; and b = +2.58 ± 0.3 Mc/sec or b = −21.64 ± 0.7 Mc/sec for the $3^2P_{3/2}$ state. The strong-field spectrum of the $3^2P_{3/2}$ state strongly indicates that the correct value of b is + 2.58 ± 0.3 Mc/sec. The possible values of Q are $+ 0.100 \pm 0.011 \times 10^{-24}$ cm for b = +2.58 Mc/sec, or $-0.836 \pm 0.028 \times 10^{-24}$ cm for b = −21.64 Mc/sec. (auth)

4556

PARAMETERS FOR THE NEUTRON RESONANCE IN GOLD. R. E. Wood, H. H. Landon, and V. L. Sailor (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 98, 639–45(1955) May 1.

A highly detailed study of the 4.906-ev neutron in Au^{197} has been made for the purpose of establishing preliminary values for a "standard" resonance. Such a standard can serve as a basis for comparing results from various neutron spectrometers and should assist in reducing large discrepancies in resonance parameters which now exist. The new measurements were made on a crystal spectrometer with unusually good resolution. Methods of "shape analysis" were used to fit the data to the one-level formula and the following parameters were obtained: $E_0 = 4.906 \pm 0.010$ ev; $\sigma_{t0}\,\Gamma^2 = (725 \pm 15) \times 10^{-24}$ cm² ev²; $\sigma_{t0} = (37\,000 \pm 500) \times 10^{-24}$ cm²; $\Gamma = 0.140 \pm 0.003$ ev; and $\sigma_p = (11.1 \pm 0.8) \times 10^{-24}$ cm². The one-level formula with these parameters gives an accurate fit to the data over the entire energy range from 0.35 to 15 ev. The nuclear radii corresponding to the two possible spin orientations of the incident neutron were found to be the same to within experimental error. (auth)

4557

TOTAL CROSS SECTION OF DEUTERIUM FOR NEUTRONS FROM 0.2 TO 22 MEV. John D. Seagrave and Richard L. Henkel (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 98, 666–9(1955) May 1.

Transmission measurements of the total neutron cross section of deuterium have been made with an accuracy of about 2 % at 29 energies between 0.2 and 22 Mev, using deuterium gas in a cell 1 meter long. The cross section decreases monotonically with increasing energy, and its reciprocal appears to be a linear function of neutron energy over the interval from 1.5 to 22 Mev: $\sigma = 14.35(E_n + 3.6 \text{ Mev})^{-1}$ barn. (auth)

4558

ANGULAR CORRELATION PARAMETERS FOR ORIENTED NUCLEI. T. P. Gray and G. R. Satchler (Clarendon Lab., Oxford, England). Proc. Phys. Soc. (London) A68, 349–50(1955) Apr.

It has been customary to give the angular distribution of radiation from oriented nuclei as a sum of intensities $I_M(\theta)$ from the M substates weighted by their population so that $I(\theta) = \Sigma\, W(M) I_M \theta$. However, by drawing on the extensive tabulation of radiation parameters by Biedenharn and Rose (Rev. Mod. Phys. 25, 729(1953)), an expression $I(\theta) = \Sigma\, A_\nu P_\nu(\cos\theta)$ may be written. The ciefficient A_ν splits into factors which depend only on the orientation process or on the two nuclear spins and radiation multipolarity of the relevant transition, and may be obtained independently. (L.M.T.)

4559

RESEARCH FOR 6-10 DAY SR → >100 DAY Y IN URANIUM FISSION. Günter Herrmann and Fritz Strassmann. Z. Naturforsch. 10a, 146-51(1955) Feb. (In German)

By the irradiation of U with slow neutrons the resulting long-lived Sr isotopes were studied. A procedure for the measurement of the decay of Sr isotopes with continuous removal of simulated daughters was perfected and its presence at the 9.7 hr Sr^{91} proven. Neither in the Sr fraction nor in Y isolated from Sr can a probable 6- to 10- day Sr → >100-day Y series be identified. The 50.5 ± 0.2 day half life of Sr^{89} is determined. The cause of irregularity in the dissociation of Sr^{89} from the fission is not clear. The estimation of the half life and energy of heavy Sr and Y isotopes is tabulated. (tr-auth)

4560

EVIDENCE FOR THE EXISTENCE OF INSTANTANEOUS SUB-STRUCTURES IN CARBON NUCLEI FROM ENERGETIC NUCLEONS. Pierre Cuer, Adham Samman, and Jean Combe. Compt. rend. 240, 1527-9(1955) Apr. 4. (In French)

Ten stars due to p(340 Mev) + C^{12} → p′ + 3α reactions were analyzed in detail. According to the (p, p′) and (p, α) angles, and the energy balance, 6 arise from primary collisions, leaving Be^{8*}. One comes from a (p, M^3) reaction, and the others are emitted by multiple collisions. In the experimental analysis, a simple and precise measuring technique uses the coefficient of contraction from (p, p-free) collisions. (tr-auth)

4561

ENERGY LEVELS OF ^{56}Fe AND ^{27}Al BY THE INELASTIC SCATTERING OF 15 MEV NEUTRONS. R. Ramanna, N. Veeraraghavan, and P. K. Iyengar (Tata Inst. of Fundamental Research, Bombay, India). Nuovo cimento (10) 1, 623-8(1955) Apr. (In English)

A stilbene scintillation spectrometer has been used to study the neutrons inelastically scattered by iron and aluminum for an incident monoenergetic beam of 15-Mev neutrons. Using good geometry, counts were taken with and without the scatterer in position, and the results were analyzed by a ratio method. For iron, levels have been obtained at 7.6, 5.8, 4.5, and 1.9 Mev. For aluminum, levels have been obtained at 8.1, 5.8, 4.0, and 3.0 Mev. Comparison with existing data from γ-ray measurements is given. (auth)

4562

ALIGNMENT OF ^{56}Co NUCLEI. PART I. EXPERIMENTAL RESULTS; DETERMINATION OF MAGNETIC MOMENT. L. J. Gallaher, Ch. Whittle, J. A. Beun, A. N. Diddens, C. J. Gorter, and M. J. Steenland. Physica 21, 117-23(1955) Feb. (In English)

A dilute copper ammonium Tutton salt, containing a small amount of Co^{56}, was cooled by adiabatic demagnetization to about 0.01°K, and an anisotropy in the angular distribution of the gamma intensity, resulting from the nuclear alignment, was found in each of the six gamma rays. An estimate of the magnetic moment of Co^{56} yielded 2.8 ± 0.9 nuclear magnetons. (auth)

4563

NUCLEAR MAGNETIC RESONANCE SPECTRUM OF B^{11} IN KERNITE. H. H. Waterman and G. M. Volkoff (Univ.

of British Columbia, Vancouver). Can. J. Phys. 33, 156-75(1955) May.

The radio-frequency spectrum of B^{11} in a single crystal of $Na_2B_4O_7 \cdot 4H_2O$ (kernite) is examined experimentally as the monoclinic crystal is rotated in an external magnetic field of 7060 gauss in turn about each of three axes (b, c crystallographic axes, and a third perpendicular direction) held normal to the magnetic field. A maximum of 21 lines (some of which show small additional splitting) is observed, which reduces to 11 when the b symmetry axis is perpendicular or parallel to the magnetic field. The results are interpreted in terms of four essentially non-equivalent B^{11} sites in kernite characterized respectively by quadrupole coupling constants $|eQ\phi_{zz}/h| = 0.645 \pm 0.003$, 0.588 ± 0.003, 2.563 ± 0.007, 2.567 ± 0.010 Mc/sec, and asymmetry parameters $\eta \equiv (\phi_{xx}-\phi_{yy})/\phi_{zz} = 0.54 \pm 0.01$, 0.60 ± 0.02, 0.163 ± 0.010, 0.116 ± 0.010. The orientations of the principal axes of the four ϕ_{ij} tensors are also determined. These observations on boron are consistent with previous x-ray results. (auth)

NUCLEAR REACTORS

4564 KAPL-1336

Knolls Atomic Power Lab., Schenectady, N. Y.

ABSORPTION OF NEUTRONS BY BLACK CONTROL RODS. H. Hurwitz, Jr. and G. M. Roe. Mar. 24, 1955. 34p. Contract W-31-109-Eng-52.

One-velocity diffusion theory is used to study the thermal neutron absorption of black control rods of various shapes under the assumption that the slowing-down density is independent of position in the neighborhood of the rod. If the neutron diffusion length L is large compared to the cross-sectional dimensions of the rod, the absorption of a cylindrical rod of arbitrary cross section is the same as that of a circularly cylindircal rod having the same equivalent electrical capacity. If the diffusion length is small, the absorption is proportional to L times the effective rod perimeter which is equal to the actual perimeter plus a correction for each corner equal to L times a function of the external angle at the corner. A general expression for the correction factor is obtained. The accuracy of the expressions for the absorption for large and small values of L is tested in the intermediate range by means of variational expressions giving upper and lower limits of the absorption. (auth)

4565 TT-534

ON THE HEAT OUTPUT OF HETEROGENEOUS NUCLEAR REACTORS WITH URANIUM TUBES. (Ueber Die Waermeleistung Heterogener Kernreaktoren Mit Uranrohren). P. Schmid. Translated by D. A. Sinclair from Arbeitsgemeinschaft Kernreaktor, Schweiz, Internal Report No. 4, Apr. 1954. 8p.

The problem of the maximum quantity of heat that may be taken from a heterogeneous reactor per cm length of U tube without damage due to excessive thermal or mechanical stress has been studied. Three cooling possibilities were considered, internal only, external only, and a combination of internal and external. Results are presented in graphical form. (M.P.G.)

4566

ORNL'S DESIGN FOR A POWER REACTOR PACKAGE. R. S. Livingston and A. L. Boch (Oak Ridge National Lab., Tenn.). Nucleonics 13, No. 5, 24-7, 46(1955) May.

The design of the core, pressure vessel, cooling and control systems, shielding, and calculations for criticality and control of a package nuclear power plant are described. Construction and operating costs are discussed. (C.H.)

4567

RADIOLYTIC-GAS BUBBLING IMPROVES CONVECTIVE HEAT TRANSFER IN SUPO. Franklin P. Durham (Los Alamos Scientific Lab., N. Mex.). Nucleonics 13, No. 5, 42-6(1955) May.

Agitation from radiolytic-gas bubbles is attributed to be the main cause of the 150% higher heat transfer coefficient than predicted by theory in the water boiler reactor. Effects of thermal-boundary layer heat generalization and tube-wall gamma heating are also analyzed. (C.H.)

4568

NUCLEAR POWER REACTORS. A REPORT TO THE U. S. ATOMIC ENERGY COMMISSION. Nuclear Power Project Staff (Foster Wheeler Corporation, New York) and (Pioneer Service Engineering Co., Chicago). Washington, U. S. Atomic Energy Commission, 1955. 30p. $0.15 (GPO).

A condensed history and description of study agreements established under the Industrial Participation Program are presented. Short unclassified descriptions of the important reactors investigated are included. An economic analysis based on certain established criteria is presented in 4 tables and results are discussed. Final conclusions of the group are summarized. (L.M.T.)

4569

REPORTS TO THE U. S. ATOMIC ENERGY COMMISSION ON NUCLEAR POWER REACTOR TECHNOLOGY. POWER GENERATION USING NUCLEAR ENERGY. Commonwealth Edison Co. and Public Service Co. of Northern Illinois. STUDY OF MATERIALS AND POWER PRODUCING REACTORS. Dow Chemical Co. and Detroit Edison Co. POWER REACTOR FEASIBILITY STUDY. Monsanto Chemical Co. and Union Electric Co. INDUSTRIAL REACTOR STUDY. Pacific Gas and Electric Co. and Bechtel Corp. Washington, U. S. Atomic Energy Commission, May 1953. 88p. $0.25 (GPO).

This booklet contains the declassified versions of reports made to the Atomic Energy Commission by four separate teams of nongovernmental industrial representatives who spent a year inside the atomic energy program appraising the prospect for private industrial participation in joint production of electric energy and fissionable material from reactors. The appraisals included examination of both technical and economic problems involved in production from nuclear reactors of electrical energy for industrial and commercial use. These declassified versions represent only about one-fourth to one-third of the bulk of the classified reports. The information they contain was selected for its value to engineers and others interested in the nuclear power outlook insofar as this was possible within the limits of the Commission's current declassification policy. (auth)

4570

APPLICATION OF MIXED BED ION EXCHANGE TO WATER PURIFICATION IN NUCLEAR REACTORS. Michael Sivetz and C. H. Scheibelhut (Argonne National Lab., Lemont, Ill.). Ind. Eng. Chem. 47, 1020-2(1955) May.

Water with a specific resistance $\sim 10^6$ ohm-cm has been obtained from mixed resin beds of strong acid and strong base polystyrene resins. These resin beds have been used at high flow rates without affecting resin capacity. A bypass

installation for water purification in reactors is outlined. (C.W.H.)

NUCLEAR TRANSFORMATION

4571 AEC-tr-2126

THE REACTION p + p → d + π^+ AT 460 MEV. M. G. Meshcheryakov, B. S. Neganov, and V. M. Sidorov. Translated from Doklady Akad. Nauk S.S.S.R. 100, 673-6(1955). 9p.

The reaction was studied at the USSR Academy of Science synchrocyclotron. The identification of the reaction was carried out by registering coincidences in two telescopes, counting the mesons in one, and the deuterons in the other. (L.M.T.)

4572

PHOTOPROTONS FROM LEAD-208 AND TANTALUM. M. Elaine Toms and William E. Stephens (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 98, 626-8(1955) May 1.

The photoprotons ejected from thin foils of Ta and enriched Pb^{208} by the 23-Mev bremsstrahlung x-rays from a betatron have been observed in nuclear emulsions. Yields, measured in units of 10^4 protons per mole per roentgen unit, are: Ta, 5.6 ± 0.5; Pb^{208}, 2.6 ± 0.3. The angular distribution of the Pb^{208} protons shows a strong forward asymmetry while the Ta protons are more isotopic. Both proton energy distribution are in good agreement with the predictions of the direct photoprocess. (auth)

4573

EXPERIMENTAL DETERMINATION OF THE ABSOLUTE DIFFERENTIAL CROSS SECTIONS FOR THE $O^{16}(d,p)O^{17}$, $O^{16}(d,p)O^{17*}$, AND $O^{18}(d,p)O^{19*}$ REACTIONS. T. F. Stratton, J. M. Blair, K. F. Famularo, and R. V. Stuart (Univ. of Minnesota, Minneapolis). Phys. Rev. 98, 629-34 (1955) May 1.

Nickel oxide foil targets were bombarded with deuterons in order to study the angular distributions of protons from the $O^{16}(d,p)O^{17}$ (ground state), $O^{16}(d,p)O^{17*}$ (0.875-Mev level), and $O^{18}(d,p)O^{19*}$ (1.468-Mev level) reactions. The absolute yield of the $O^{16}(d,p)O^{17}$ ground-state reaction was measured at $\theta_{cm} = 53°$ in 35-kev steps of laboratory deuteron energy from 2.3 Mev to 3.9 Mev. A resonant-type yield was obtained, with cross sections per unit solid angle at $\theta_{cm} = 53°$ of 17 mb at 2.65 Mev, 33 mb at 3.01 Mev, 19 mb at 3.25 Mev and 31 mb at 3.43 Mev. Angular distributions obtained over twenty-two center-of-mass angles from 5° to 161° at these four deuteron energies showed a forward maximum at 53° falling to a minimum of 13 mb in the neighborhood of 90° and rising gradually to 16 mb in the back angles. Fluctuations of intensity at the forward maximum provided the major contribution to maxima in the total yield at 3.0 Mev and 3.4 Mev. Differential cross sections for the $O^{16}(d,p)O^{17*}$ (0.875-Mev level) were measured at incident deuteron energies of 3.01 Mev and 3.43 Mev. The distributions obtained were of the typical stripping type with $l_n = 0$. With NiO targets enriched to 23% in O^{18}, an angular distribution was obtained with 3.01-Mev deuterons for the $O^{18}(d,p)O^{19*}$ (1.468-Mev level) reaction. The distribution was of the character of a typical $l_n = 0$ type stripping distribution with cross sections of 213 mb at 5°, falling to a minimum of 11 mb at 48° and rising to a secondary maximum of 27 mb at 84°. A spin and parity assignment of $\frac{1}{2}$, + to the 1.469-Mev level in O^{19} was made on the basis of the observed distribution. (auth)

4574

LOW-ENERGY PROTONS FROM TARGETS BOMBARDED BY 15-MEV DEUTERONS. F. A. Aschenbrenner (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 98, 657-65(1955) May 1.

A particle-selection technique is described which makes it possible to identify readily the reaction particles from deuteron-induced reactions. The results of a study of the low-energy protons from targets bombarded by 15-Mev deuterons is presented. The proton energy spectra from Nb, Ag, Sb, Ta, three Pb isotopes, and U bombarded with the direct deuteron beam were observed at several angles. In addition, the proton energy spectrum from Ta was observed at several deuteron beam energies ranging from approximately 10.5 to 15 Mev. The low-energy parts of the proton spectra show what appears to be a Coulomb barrier effect. However, protons are observed several Mev below the Coulomb barrier for protons, indicating that the barrier effect differs from the ordinary Coulomb barrier penetration of protons emerging from a compound nucleus. The behavior of the barrier effect with respect to changes in counter angle, Z (atomic number), and A (mass number) of the targets, and deuteron beam energy was observed. (auth)

4575

NUCLEAR ENERGY LEVELS OF Be^8 FROM $Li^7(d,n)Be^8$. M. A. Ihsan (Government Coll., Lyallpur, Punjab, Pakistan). Phys. Rev. 98, 689-90(1955) May 1.

The nuclear energy levels of Be^8 have been investigated by observing the neutron groups emitted when an isotopic target of Li^7 is bombarded by 0.7-Mev deuterons. Evidence of levels in Be^8 was found at 2.98 and 7.53 Mev, and of a probable level at 5.30 Mev. (auth)

4576

YIELD OF HIGH-ENERGY GAMMA RAYS FROM PROTON CAPTURE IN Be^9. O. Lönsjö, O. Os, and R. Tangen (Univ. of Oslo, Blindern, Norway). Phys. Rev. 98, 727-8(1955) May 1.

Two yield curves have been taken for γ rays of energy above 2.5 and 5.6 Mev respectively, with proton energies from 150 kev up to 518 kev. The curve for γ rays above 2.5 Mev shows a single broad resonance around 330-kev proton energy. After correction for barrier penetration the curve can be fitted by a Breit-Wigner formula with resonance energy 307 kev (corresponding to a level in B^{10} at 6.86 Mev) and with half-width 160 kev. The curve for γ rays above 5.6 Mev also shows a nonresonant radiation, which consists of more energetic components. (auth)

4577

FINE STRUCTURE IN THE (γ,p) REACTION IN OXYGEN. W. E. Stephens, A. K. Mann, B. J. Patton, and E. J. Winhold (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 98, 839-40(1955) May 1.

An oxygen target was bombarded with 25-Mev bremsstrahlung, and the energy distribution of 1123 protons ejected at angles between 30 and 150° relative to the x-ray beam was determined. With the aid of recent assignments by Spicer from (γ,p) cross section work in oxygen up to 18.7 Mev, the energy spectrum is transformed into a cross-section curve for photon absorption giving rise to the ground state of N^{15}. The main resonance at 22.4 Mev and the fine

structure at 19.6 and 20.6 Mev appear to comprise what is usually considered a photonuclear "giant" resonance. Their location and magnitudes are consistent with observations of the oxygen (γ,n) reaction. (L.M.T.)

4578

THE DISINTEGRATION OF ^{7}Be BY SLOW NEUTRONS. R. C. Hanna (Atomic Energy Research Establishment, Harwell, Berks, England). Phil. Mag. (7) 46, 381-92(1955) Apr.

The reaction Be^{7} (n,p) Li^{7} has been identified for neutrons incident with thermal energies. The cross section has been measured as $5.3 \pm 0.8 \times 10^{-28}$ cm^2. The cross section for the reaction Be^{7} (n,α) He^{4} does not exceed 1 barn. The results show the parity of Be^{7} to be odd. The activity of Be^{7} source has been diminished by neutron bombardment. The cross section for all processes leading to the destruction of Be^{7} is found to be the $4.8 \pm 0.9 \times 10^{-28}$ cm^2. A comparison of the Be^{7} (n,p) Li^{7} and Li^{7}(p,n)Be^{7} cross sections gives evidence for a level in Be^{8} near the neutron threshold of width not exceeding 30 kev. (auth)

4579

NOMOGRAPH FOR ANGULAR DISTRIBUTIONS IN STRIPPING REACTIONS. C. R. Lubitz and W. C. Parkinson (Univ. of Michigan, Ann Arbor). Rev. Sci. Instr. 26, 400-1(1955) Apr.

PARTICLE ACCELERATORS

4580 CERN-PS/MM-12

[European Organization for Nuclear Research, Geneva.] AIMANT DC IV. 1ère ETUDE. (Magnet DC IV. First Study). Feb. 1955. 32p.

Studies of the magnetic characteristics of various pole-tip profiles for the CERN synchrotron are to be made with the DC IV model magnet. This unit provides for any pole-tip contour by making the pole pieces of 10-mm thick sheets that can be positioned at will. In these measurements, a hyperbolic profile (xy = 129.10 cm^2) with n = 278 was used. (K.S.)

4581 CERN-PS/MM-13

[European Organization for Nuclear Research, Geneva.] ETUDE PRELIMINAIRE DU MODELE AC V AVEC ALIMENTATION CONTINUE. (Preliminary Study of the Model AC V [Magnet] with Direct Current Supply). Feb. 1955. 26p.

Magnetic measurements were made in the gap and in the iron of the AC V model magnet for the CERN synchrotron. The pole tip profile corresponds to a portion of the hyperbola xy = 129.10 cm^2. (K.S.)

4582 CERN-PS/PL-3

[European Organization for Nuclear Research, Geneva.] INJECTION DANS LE SYNCHROTRON. REGLAGE DE L'ACCEPTANCE DU SYNCHROTRON. (Injection in the Synchrotron. Regulation of the Acceptance of the Synchrotron). Feb. 1955. 35p.

4583

OPERATION OF A HIGH-VOLTAGE CASCADE GENERATOR. E. J. Bertomeu and C. A. Mallmann. Publs. com. nacl. energia atomica (Buenos Aires), Misc., No. 1, 1-16 (1954). (In Spanish)

The theory of a high-tension cascade generator is given, developing the general formulas to calculate the voltage drop and ripple. We consider the particular case of an instrument which uses mercury vapour rectifiers, taking into account the advantages and disadvantages of these and other types of rectifiers. (auth)

4584

THE STABILITY OF ORBITS IN THE STRONG FOCUSING SYNCHROTRON. Joseph Seiden. Ann. phys. 10, 259-304 (1955) Mar.-Apr. (In French)

RADIATION ABSORPTION AND SCATTERING

4585 AEC-tr-2125

EXCHANGE SCATTERING OF 380 MEV NEUTRONS ON DEUTERONS AND SPIN DEPENDENCE OF EXCHANGE FORCES. V. P. Dzhelepov, Yu. M. Kabarinov, and V. B. Flyagin. Translated by Luke C. L. Yuan from Doklady Akad. Nauk S.S.S.R. 100, 655-8(1955). 7p.

The spin dependences of the exchange forces which are effective in the n-p system are investigated by the observation of proton ejection angles from the exchange collisions of 380-Mev neutrons with deuterons, and comparing these results with previously obtained data on the scattering of neutrons by free protons. Differential cross sections of the exchange collisions are determined for several ejection angles with values close to 0°. (C.W.H.)

4586

ANGULAR CORRELATION OF PHOTONS FROM POSITRON ANNIHILATION IN LIGHT METALS. R. E. Green and A. T. Stewart (Dalhousie Univ., Halifax, Nova Scotia). Phys. Rev. 98, 486-91(1955) Apr. 15.

The angular correlation of gamma rays from positron annihilation in the light metals, Li, Be, Na, Mg, Al, K, and Ca, has been measured. The deviation of the two photons from colinearity is a measure of the total momentum of the annihilating electron-positron pair. If it is assumed that the positrons are thermalized before annihilation and that they annihilate only with electrons of a Sommerfeld free electron gas, the experimental results may be used to determine the Fermi energy of these electrons. It is interesting that the Fermi energies so determined are in good agreement with calculated values. (auth)

4587

MAGNETIC SCATTERING OF SLOW NEUTRONS BY GASEOUS OXYGEN. H. Palevsky and R. M. Eisberg (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 98, 492-4(1955) Apr. 15.

The scattering of neutrons by oxygen was measured as a function of wavelength from 2.5 to 10 A. By subtracting the calculated nuclear contribution the magnetic scattering is established. The magnitude of the magnetic interaction at long wavelengths is found to be in agreement with the theory of Halpern and Johnson. The measurement is not very sensitive to the details of the spatial distribution of the magnetic electrons. However, the observed wavelength dependence of the magnetic scattering is in agreement with the calculations of Kleiner based on the oxygen wave function derived by Meckler. (auth)

4588

MEASUREMENT OF SCATTERING CROSS SECTIONS FOR LOW-ENERGY NEUTRON RESONANCES. C. Sheer and J. Moore (Columbia Univ., New York). Phys. Rev. 98, 565-78(1955) May 1.

The thick-target method for the measurement of the ratio of total to scattering cross section for low-energy neutrons as a function of energy has been extended to include semi-

thick targets. A family of calibration curves has been developed by means of which the measured scattered count may be interpreted in terms of (σ_s/σ_t) in the range 0–1. The 5.19-ev and 16.6-ev levels of silver have been investigated by this method. The data agree very well with a Breit-Wigner shape over a wide range centered at the resonance, although slight deviations can be noted at distance >~10Γ away from resonance. The scattering measurements yield three independent ratios between various groups of the Breit-Wigner parameters. These ratios may be used together with transmission data to calculate the parameters. The results obtained for silver are for the 5.19-ev level: $\Gamma = 0.128$ ev, $\Gamma_n = 0.0155$ ev, $\sigma_{t0} = 22\,200$ barns, $R_{J=1} = 0.66$ barn$^{1/2}$; for the 16.6-ev level: $\Gamma = 0.110$ ev, $\Gamma_n = 0.039$ ev, $\sigma_{t0} = 7300$ barns, $R_{J=0} = 1.10$ barn$^{1/2}$; σ_p(normal element) = 5.90 barns. (auth)

4589

GAMMA RADIATION FROM NEUTRON INELASTIC SCATTERING. G. L. Griffith (Westinghouse Research Labs., East Pittsburgh, Penna.). Phys. Rev. 98, 579–82(1955) May 1.

Energy measurements have been made by means of a scintillation spectrometer of the gamma rays produced by bombarding several elements with 4.5-Mev neutrons. The following gamma rays have been found (energies in Mev): B: 0.70, 2.20; F, 1.34, 6.10; Al: 0.84, 1.02, 2.27, 3.10; Fe: 0.85, 1.20, 173, 2.05, 2.50, 3.52; Zr: 0.92, 2.20, 3.23; Pb: 0.79, 1.36, 2.70. These energy values can be used to determine accurate values of the nuclear energy levels for those elements where the level scheme has been determined uniquely by observations on the scattered neutron energy spectrum. (auth)

4590

SCATTERING OF 4.4-MEV NEUTRONS BY IRON AND CARBON. B. Jennings, J. Weddell, and I. Alexeff (Westinghouse Research Labs., East Pittsburgh, Penna.) and R. L. Hellens (Westinghouse Atomic Power Division, Pittsburgh, Penna.). Phys. Rev. 98, 582-5(1955) May 1.

The results of photographic measurements of the neutron spectrum from the scattering at 90° of 4.4-Mev neutrons by iron have been combined with measurements of the energies of de-excitation gamma rays from the same process (see preceding abstract) to give values for the energy levels excited in Fe^{56}. The $(d\sigma/d\Omega)_{90°}$ for the various processes have been estimated from the areas under the peaks in the histogram. The energy levels and corresponding $(d\sigma/d\Omega)_{90°}$ for Fe^{56} are: elastic 0.076 ± 0.02 barn/sterad; inelastic 0.85 ± 0.02 Mev, 0.036 ± 0.010 barn/sterad; 2.05 ± 0.036 Mev, 0.021 ± 0.007 barn/sterad; 2.58 ± 0.054 Mev, 0.012 ± 0.006 barn/sterad, 2.90 Mev. 0.020 ± 0.013 barn/sterad. Similar measurements on carbon resulted in a $(d\sigma/d\Omega)_{90°}$ for the elastic process of 0.061 ± 0.016 barn/sterad. (auth)

4591

DEUTERON-HELIUM DIFFERENTIAL SCATTERING CROSS SECTIONS. A Galonsky, R. A. Douglas, W. Haeberli, M. T. McEllistrem, and H. T. Richards (Univ. of Wisconsin, Madison). Phys. Rev. 98, 586-90(1955) May 1.

Deuteron-helium elastic scattering cross sections have been measured from $E_d = 0.28$ to 4.62 Mev. A resonance at $E_d = 1.070$ Mev and Γ ~ 35 kev was observed at 9 angles from 90° to 173.6° c.m. This resonance corresponds to the previously observed 2.187-Mev state of Li^6. No scattering anomaly was observed at the deuteron energy corresponding to the known 3.58-Mev level of Li^6. This negative result is consistent with an assignment of $J = 0^+$, $T = 1$ to this state. A very broad scattering anomaly is observed from about 3 to 4.62 Mev. Most of the cross section measurements are good to 3% or better in absolute magnitude. (auth)

4592

ENERGY LEVELS OF Li^6 FROM THE DEUTERON-HELIUM DIFFERENTIAL CROSS SECTIONS. A. Galonsky and M. T. McEllistrem (Univ. of Wisconsin, Madison). Phys. Rev. 98, 590-9(1955) May 1.

The deuteron-helium differential cross sections presented (see preceding abstract) have been analyzed in terms of a dispersion formalism to classify energy levels of Li^6. A level at $E_x = 2.185$ Mev is confirmed to be a single particle, 3^+, $T = 0$ level. The broad anomaly extending from 3 Mev to the limit of observation, 4.62 Mev, cannot be analyzed in terms of a single level. Instead, it has been fitted with two single-particle levels, a 2^+ level at $E_x = 4.53$ Mev in Li^6 and a 1^+ level at 5.4 ± 0.5 Mev. The 1^+ level cannot be located more accurately because only the tail is visible at the bombarding energies available. All of the other two-level combinations have been ruled out. The assignments, (3^+, 2^+, 1^+), and locations of the levels agree with an intermediate coupling model which is close to the L–S extreme. In the neighborhood of and above the 3^+ resonance the usual hard-sphere phase shifts, which are always negative, cannot be used for the P-wave. This result may indicate odd-parity states above the presently investigated energy region. For the other partial waves, hard-sphere phase-shifts corresponding to radii anywhere from 3 to 5×10^{-13} cm were satisfactory, provided the reduced width of the ground state of Li^6 was simultaneously varied from the Wigner limit to very small values. (auth)

4593

GAMMA RADIATION FROM POLONIUM NEUTRON SOURCES. R. J. Breen and M. R. Hertz (Mound Lab., Miamisburg, Ohio). Phys. Rev. 98, 599-604(1955) May 1.

A NaI(Tl) crystal scintillation spectrometer was used to investigate the gamma spectrum from Po-alpha bombardment of Li, Be, B, F, Na, Mg, and Al. The principal gamma energies observed were: Li, 0.483 Mev; Be, 4.45 Mev; B, 2.36 and 3.68 Mev; F, 1.28 and 1.51 Mev; Na, 1.83 and 2.57 Mev; Mg, 130, 182, and 2.97 Mev; Al, 1.25, 2.28, and 3.55 Mev. The probable origin of the gammas is discussed. (auth)

4594

RANGE STRAGGLING IN NUCLEAR TRACK EMULSION. Walter H. Barkas, Frances M. Smith, and Wallace Birnbaum (Univ. of California, Berkeley). Phys. Rev. 98, 605-10(1955) May 1.

The contributions to the range variance in nuclear track emulsion have been studied and the magnitude of the various effects calculated. Bohr straggling is found to be the most important effect when the energy is high, but for slow particles, a number of others combine to dominate the straggling. Range errors caused by distortion are also studied. Measurements are reported on the straggling of eighteen particle groups consisting of protons, pions, and muons. With the particle mass and velocity as variable parameters, the theoretical estimates are tested and a detailed accounting of the contributions to the straggling is made. (auth)

4595

LIQUID SCINTILLATOR MEASUREMENTS OF ANGULAR ELASTIC SCATTERING OF NEUTRON FROM CARBON,

ALUMINUM, AND SULFUR. R. N. Little, Jr., B. P. Leonard, Jr., J. T. Prud'homme, and L. D. Vincent (Univ. of Texas, Austin). Phys. Rev. 98, 634-8(1955) May 1.

Angular elastic scattering cross sections have been measured for carbon, aluminum, and sulfur using 2.7-Mev neutrons from the D(d,n) reaction. A liquid organic scintillator, terphenyl in xylene, was used as the neutron detector. The differential pulse-height spectra for the neutrons scattered from sulfur and for Co^{60} gamma rays are given. (auth)

4596

ELASTIC SCATTERING ANGULAR DISTRIBUTIONS OF FAST NEUTRONS ON LIGHT NUCLEI. Harvey B. Willard, Joe K. Bair, and Joe D. Kington (Oak Ridge National Lab., Tenn.). Phys. Rev. 98, 669-73(1955) May 1.

New measurements of the total cross section of Be^9 (resolution 4 kev) give maxima of 7.75 ± 0.20 barns (Γ = 25 kev) and 5.25 ± 0.20 barns (Γ = 8 kev) for the 0.62 Mev and 0.81 Mev resonances, consistent with J = 3 and J = 2 for the respective compound state spin values. Elastic scattering angular distributions indicate that the 0.62-Mev resonance may be formed by p-wave neutrons with the s-wave potential scattering ($\delta_0 = -54.2°$) spin-dependent and all channel spin 1, or possibly by d-wave neutrons with the resonance scattering all channel spin 2. Potential scattering phase shifts for B^{10} are $\delta_0 = -53.5°$ at 0.55 Mev; $\delta_0 = -60.7°$, $\delta_1 = -4.0°$ at 1.00 Mev; and $\delta_0 = -66.9°$, $\delta_1 = -10.3°$, and $\delta_2 = -2.9°$ at 1.50 Mev. The 0.43-Mev resonance in B^{11}, agrees with a J = 2, l = 1 assignment, while the 1.28-Mev resonance is best fitted by J = 3, l = 2; with a mixing ratio of channel spin 2 equal to 10 times channel spin 1. Potential scattering is nearly all s-wave up to 1.50 Mev where $\delta_0 = 90°$. C^{12} has pure s-wave scattering at 0.55 Mev ($\delta_0 = -50.1°$) and 1.00 Mev ($\delta_0 = -68.9°$), and at 1.50 Mev a small amount of p-wave appears, ($\delta_0 = -79.4°$, $\delta_1 = -5.7°$). In general the observed s-wave phase shifts are larger than those calculated from a hard sphere model, whereas the p- and d-wave phase shifts are smaller. (auth)

4597

INTERACTION OF 4.1-MEV NEUTRONS WITH NUCLEI. M. Walt and J. R. Beyster (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 98, 677-84(1955) May 1.

The differential cross sections for elastic scattering of 4.1-Mev neutrons by Be, C, Al, Ti, Fe, Zn, Zr, Cd, Sn, Ta, W, Au, Pb, and Bi were measured using a biased scintillation detector with thresholds at about 2.0, 2.6, and 3.2 Mev. Multiple scattering corrections were made by an approximate method, the accuracy of which was investigated by Monte Carlo calculations. Inelastic collision cross sections and elastic transport cross sections were computed from the data. The experimental results are compared with theoretical cross sections calculated using the complex square-well potential of Feshbach, Porter, and Weisskopf. (auth)

4598

GAMMA RAYS FROM THE INELASTIC SCATTERING OF NEUTRONS IN ALUMINUM, MAGNESIUM, AND SILVER. L. A. Rayburn, D. L. Lafferty, and T. M. Hahn (Univ. of Kentucky, Lexington). Phys. Rev. 98, 701-4(1955) May 1.

Monoenergetic neutrons from the $H^2(d,n)He^3$ reaction were used to bombard scatterers in the form of a ring surrounding an unshielded NaI(Tl) gamma spectrometer. The γ spectrum for each scatterer was obtained by subtracting the background counting rate from the counting rate with the scatterer in place. An analysis of the γ spectra yields discrete γ rays for each scatterer as follows: Al: 0.422*, 0.843, 0.988, 1.69, and 2.10 Mev; Mg: 0.438, 0.555, 0.688, 0.837, 1.00, 1.34, 1.91, 2.08*, and 2.44 Mev; Ag: 0.332*, 0.696, 0.795, 1.10, 1.99, 2.13*, 2.32, and 2.54* Mev. The starred γ energies denote those that have not been previously reported. (auth)

4599

PHOTODISINTEGRATION OF THE DEUTERON BY 95-MEV BREMSSTRAHLUNG. Lew Allen, Jr. (Univ. of Illinois, Champaign). Phys. Rev. 98, 705-10(1955) May 1.

Photoprotons produced by irradiating deuterium gas with betatron x rays have been detected with stacks of unsupported Ilford emulsions. The differential cross section was determined for photon energies between 20 and 65 Mev and for seven angles of proton emission. The observed angular distributions are well fitted by $f(\theta) = (\alpha + \sin^2\theta)(1 + 2\beta\cos\theta)$. The experimental results for angular distribution and total cross section have been compared with theoretical predictions assuming a purely central force. Striking departures from the central force theory are observed as the photon energy increases from 20 Mev. (auth)

4600

ABSOLUTE MAGNETIC ANALYSIS OF $F^{19}(p,p')F^{19*}$ REACTION. C. R. Gossett, G. C. Phillips, and J. T. Eisinger (Rice Inst., Houston, Tex.). Phys. Rev. 98, 724-7(1955) May 1.

An annular magnetic spectrometer has been used to study groups of protons scattered inelastically from the two lowest excited states of F^{19}. The results of six experiments at bombarding energies between 2.1 and 4.5 Mev indicate an assignment of 110.4 ± 0.6 and 197.8 ± 1.2 kev, respectively, for these levels. No other groups ascribable to F^{19} were observed in the region of excitation up to 730 kev, and no multiplet structure was observed for either of the F^{19} groups. The experiments were capable of detecting proton groups with an intensity with respect to the ground-state group of 2%. Doublet separations of 3 kev would have been detected. (auth)

4601

DIFFERENTIAL ELASTIC SCATTERING CROSS SECTION FOR NEUTRONS ON NITROGEN. J. L. Fowler and C. H. Johnson (Oak Ridge National Lab., Tenn.). Phys. Rev. 98, 728-35(1955) May 1.

Two independent methods were used to measure the angular distribution for elastic scattering of neutrons from nitrogen in the neutron energy range from 0.80 to 2.36 Mev. The scattered neutrons were counted directly in order to obtain the absolute differential cross section at four neutron energies. These curves provide information on the potential scattering for energies below 1.54 Mev. The second technique, which observed the recoil nitrogen nuclei, allowed a study of scattering at the resonances. In this manner parities were established for levels in N^{15} as follows: The 1.120, 1.401, 1.595, and 2.25-Mev levels have odd parity; the 1.779-Mev level has even parity and a tentative assignment of even parity was made for the 1.350-Mev level. J-values associated with resonances at 1.12 and 2.25 Mev were each assigned to be $\frac{3}{2}$ rather than the values favored in the literature. (auth)

4602

NEUTRON SPECTRUM AND ABSOLUTE YIELD OF A

PLUTONIUM-BERYLLIUM SOURCE. Leona Stewart (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 98, 740-3(1955) May 1.

A Pu-Be neutron source has the advantages of high neutron yield, low γ intensity, and very long half life. The neutron spectrum from such a source, composed of 13 g of Pu and 7 g of Be as $PuBe_{13}$ (density 3.7 g/cc), was measured by means of proton recoils in nuclear research emulsions. The data obtained from 2057 observations indicate the neutrons have a maximum energy of approximately 10.5 Mev with broad intensity maxima at 4.0, 7.2, and 9.7 Mev. The observed spectrum shows marked similarities with published data on neutrons from Po-Be and Ra-Be sources. A comparison is made between the present data and previously reported energy levels in the residual carbon nucleus. The absolute yield of neutrons above 0.5-Mev energy is 1.2×10^6 neutrons/sec. (auth)

4603

NUCLEAR DISPERSION CONTRIBUTION TO HIGH-ENERGY ELECTRON SCATTERING. L. I. Schiff (Stanford Univ., Calif.). Phys. Rev. 98, 756-60(1955) May 1.

An expression for the contribution of virtual intermediate states of the nucleus (nuclear dispersion) to the elastic and inelastic scattering of high-energy electrons is obtained. The closure relation for the nuclear states is used to put this in a form which depends only on the properties of the initial and final states. An estimate of this contribution in comparison with the first-order scattering shows that it is expected to be small but not negligible for the light elements and somewhat larger for the heavy elements, when the electrons have several hundred Mev energy. The estimate is only valid for large scattering angles. More detailed knowledge of the one- and two-proton transition charge densities would be required in order to extend the range of validity. It seems likely that the bulk of the dispersion correction would be taken into account if the correct electron wave functions in the static Coulomb field were to be used in place of plane waves. (auth)

4604

SCATTERING OF MESONS BY LIGHT NUCLEI. L. S. Kisslinger (Indiana Univ., Bloomington). Phys. Rev. 98, 761-5(1955) May 1.

An improved optical model is used to study the scattering of mesons by light nucli, C^{12} in particular. It is found that the differential cross section can be fit reasonably well if a nucleus is used which has a diffuse edge; the Gaussian shape seems to work well for C^{12}. (auth)

4605

POLARIZATION EFFECTS IN THE REACTION $p + p \rightarrow \pi^+ + d$. L. Wolfenstein (Carnegie Inst. of Tech., Pittsburgh, Penna.). Phys. Rev. 98, 766-9(1955) May 1.

The reaction $p + p \rightarrow \pi^+ + d$ is represented by a matrix operating on the initial spin state on the assumption that the pion leaves only in s- and p-waves. This matrix is determined by five real parameters which may be experimentally determined by measurements of the different types of the outgoing deuterons and also of the asymmetry produced by incident polarized protons. Some effects of d-waves on the latter are considered. (auth)

4606

VACUUM POLARIZATION AND PROTON-PROTON SCATTERING. Leslie L. Foldy (Institute for Theoretical Physics, Copenhagen, Denmark and Case Inst. of Tech., Cleveland, Ohio), and Erik Eriksen (Institute for Theoretical Physics, Copenhagen, Denmark and Univ. of Oslo, Blindern, Norway). Phys. Rev. 98, 775-9(1955) May 1.

An attempt is made to verify the presence of effects due to vacuum polarization in available experimental data on proton-proton scattering. In spite of the smallness of these effects and relatively large errors in the data, it appears that the data substantiates the predicted effects of vacuum polarization on the electrostatic interaction of two protons, particularly on the assumption of a Yukawa shape for the nuclear potential. By correcting the available data for these effects, new values are obtained for the zero-energy scattering length and effective range of the nuclear interaction between two protons. The results in the notation of Blatt and Jackson are: $-R/\alpha = 3.704$, $r_s = 2.76 \times 10^{-13}$ cm. (auth)

4607

ROTATION OF POLARIZATION VECTOR AND DEPOLARIZATION IN p-p SCATTERING. T. Ypsilantis, C. Wiegand, R. Tripp, E. Segrè, and O. Chamberlain (Univ. of California, Berkeley). Phys. Rev. 98, 840-2(1955) May 1.

Two configurations are presented for studying the change in the state of polarization, one which illustrates triple-scattering in the same plane, and the other which represents triple-scattering in which the second scattering plane is perpendicular to the first. With such arrangements experiments were performed with 310-Mev protons on protons, and plots are included which show the depolarization factor D, and the rotation factor R, as functions of the c.m. scattering angle. (L.M.T.)

4608

SCATTERING OF HIGH-ENERGY NEUTRONS AND JOHNSON-TELLER TYPE NUCLEI. Yoshihiro Nakano (Hokkaido Gakugei Univ., Sapporo, Japan). Phys. Rev. 98, 842-3(1955) May 1.

The optical method of the Fernback-Serber-Taylor theory (Phys. Rev. 75, 1352(1949)) is extended to the Johnson-Teller-type nonuniform nuclear model (Phys. Rev. 93, 357(1954)) to derive formulas for σ_t, σ_a, and σ_d, for neutron scattering in the 275- to 410-Mev region. (L.M.T.)

4609

DEUTERON PICKUP BY HIGH-ENERGY POLARIZED PROTONS. B. J. Malenka (Washington Univ., St. Louis, Mo.). Phys. Rev. 98, 843-4(1955) May 1.

An idea of the consequences of direct deuteron pickup is obtained by considering a simple two-dimensional classical model of the type employed by Newns (Proc. Phys. Soc. (London) A66, 477(1953)) for the stripping reaction. (L.M.T.)

4610

SCATTERING OF 1.33-MEV GAMMA RADIATION BY THE ELECTRIC FIELD OF NUCLEI. Lazare Goldzahl and Philippe Eberhard. Compt. rend. 240, 965-8(1955) Feb. 28. (In French)

The elastic scattering of 1.33-Mev γ radiation from Co^{60} was measured at various angles for lead and at 50° for U. The results indicate the scattering of radiation by the nuclear electric field. (tr-auth)

4611

THE NUCLEAR SCATTERING OF ELECTRONS BY URANIUM. H. N. Yadav (Patna Univ., India). Proc. Phys. Soc. (London) A68, 348(1955) Apr.

The differential cross sections for the elastic scattering

of electrons by the Coulomb field of the U nucleus were calculated for the energy range 0.145 mc^2–20 mc^2, using Mott's formula (Mott and Massey, Theory of Atomic Collisions, Oxford: University Press, p. 80 (1949)). (auth)

4612

POSITRONIUM FORMATION IN GASES AND ITS PRESSURE DEPENDENCE. C. B. O. Mohr (Univ. of Melbourne, Australia). Proc. Phys. Soc. (London) A68, 342-4(1955) Apr.

The fractions of positrons which annihilate from the free state or bound state when they pass through atomic H at various pressures are calculated, and results are discussed. (L.M.T.)

4613

THE NUCLEAR SCATTERING OF ELECTRONS AND POSITRONS AT 0.7 AND 1.4 MEV. J. Ellis and C. Henderson (Univ. Coll., London). Proc. Roy. Soc. (London) A229, 260-71(1955) Mar.

An experiment is described in which electrons and positrons are scattered, under identical conditions, at energies of 0.7 and 1.4 Mev by foils of aluminum, silver, and gold. Both the incident and scattered particles are counted by making use of the fast response and good energy resolution of anthracene crystals. The incident beam, which is in the form of a divergent hollow cone of semi-vertical angle of near 10°, and of 5% energy spread, is provided by using radioactive sources in a β-ray spectrometer. Effective angles of scattering of 22.8, 34.5, and 47.5° are employed. It is concluded that, within the experimental accuracy of about ±5%, the results are in accordance with predictions of the Dirac theory. (auth)

4614

A PHASE SHIFT ANALYSIS OF THE SCATTERING AND POLARIZATION IN HIGH-ENERGY PROTON-PROTON COLLISIONS. C. A. Klein (Laboratoire de Physique de l'Ecole Normale Superieure, Paris). Nuovo cimento (10) 1, 581-9(1955) Apr. (In French)

The results of measurements on the scattering and polarization of single and double collisions, at energies of 100 to 400 Mev, were analyzed by phase shifts of the ^1S and ^3P_j waves for j = 0, 1, and 2. Only a limited number of solutions is in satisfactory agreement with experiment on scattering and polarization. Among these solutions are those which account for the inversion of nuclear levels suggested by the Mayer-Jensen theory of the shell model, and which corresponds to a central nuclear potential associated with a repulsive core of the Jastrow type. It is noted that the angular variation of the polarization near 300 Mev cannot be reproduced without using the phase shifts associated with the ^3F states. (tr-auth)

4615

ON THE RANGE-ENERGY RELATION FOR SLOW α-PARTICLES IN ARGON. G. Bertolini and M. Bettoni (Istituto di Fisica Sperimentale del Politecnico, Milan, Italy). Nuovo cimento (10) 1, 644-50(1955) Apr. (In English)

The range-ionization curve for α particles in argon has been obtained in the region of 0.25 to 3.5 Mev. A grid ionization chamber containing two sources of α particles was used for measurements. The sources were placed in such a way as to emit particles in the direction of and perpendicularly to the field. The different rise time of the tracks running parallel and perpendicular to the electric field enables the range of the α particles to be determined, while the amplitude enables the energy to be found. The range-energy curve is obtained by assuming a strict proportionality between the total ionization produced and the energy of the α particle. By comparison with the Bethe range-energy curve in air, the stopping power in argon is obtained. (auth)

4616

S AND P WAVE ANALYSIS OF PROTON-PROTON SCATTERING EXPERIMENTS. L. Beretta, E. Clementel, and C. Villi (Univ. of Padova and Trieste, Italy). Nuovo cimento (10) 1, 739-41(1955) Apr. (In English)

An S and P wave analysis of p-p scattering experiments is outlined which gives a clear insight in the phase-shift mechanisms in fitting the experimental data and which was found suitable for scattering analysis at intermediate energies, where the angular dependence of the nuclear term in the p-p cross sections cannot be neglected. (L.T.W.)

4617

MEASUREMENT OF THE CROSS-SECTION AND THE ENERGY SPECTRUM IN THE DOUBLE COMPTON EFFECT. A. Bracci, C. Coceva, L. Colli, and R. Dugnani Lonati (Laboratori CISE, Milan, Italy). Nuovo cimento (10) 1, 752-5(1955) Apr. (In English)

4618

A CLASSICAL TREATMENT OF THE SCATTERING OF ELECTROMAGNETIC WAVES BY NUCLEONS. Iwao Sato and Yoshihiko Ichikawa (Tohoku Univ., Japan). Progr. Theoret. Phys. (Japan) 12, 812-14(1954) Dec.

Brueckner and Case (Phys. Rev. 83, 1141(1951)) applied the classical meson theory to the production of mesons by photons on nucleons, and succeeded in explaining the copious production of neutral mesons and other general features. In this note the same method is used to investigate the scattering of electromagnetic waves by nucleons. (L.M.T.)

RADIATION EFFECTS

4619 AERE-T/R-1540

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

DIFFUSION COEFFICIENTS IN COPPER UNDER FAST NEUTRON IRRADIATION. W. M. Lomer. Dec. 1954. 15p.

The vacancy diffusion model of Cu was used to estimate the effects of neutron irradiations on the diffusion coefficients in Cu. It was concluded that measurements of diffusion properties under irradiation are not likely to yield significant information on the properties of point defects. (C.W.H.)

4620

CONDUCTIVITY INDUCED IN MICA BY X-RAYS. J. F. Fowler and F. T. Farmer (Royal Victoria Infirmary, Newcastle upon Tyne, England). Nature 175, 648(1955) Apr. 9.

The behavior of mica under x irradiation is described and is compared with that of organic plastic insulating materials and amber. (C.H.)

4621

HIGH-TEMPERATURE UNDERWATER IRRADIATION FACILITY. Fred Hittman and Otto A. Kuhl (Brookhaven National Lab., Upton, N. Y.). Nucleonics 13, No. 5, 60(1955) May.

A facility is described which was designed for determining the effects of high-intensity γ irradiation on

various structural materials and chemical systems at temperatures ranging from room temperature to 500°C. An underwater irradiation chamber and Co^{60} sources are used. (C.H.)

4622

NEUTRON IRRADIATION EFFECTS IN Cu AND Al AT 80°K. A. W. McReynolds, W. Augustyniak, Marilyn McKeown (Brookhaven National Lab., Upton, N. Y.) and D B. Rosenblatt (Frankford Arsenal, Philadelphia). Phys. Rev. 98, 418-25(1955) Apr. 15.

A cryostat is described for pile neutron irradiation in the BNL reactor of samples at liquid nitrogen temperature. One-month irradiation resulted in resistivity increases of 20 and 33% for Cu and Al, respectively, at 80°K, and increases by about a factor of 5 in critical shear stress for both. Subsequent studies of the kinetics of recovery processes were made by a number of isothermal annealing curves at various temperatures from −80°C to 500°C. In copper, two-thirds of the resistivity effect anneals out from −80° to 20°C, activation energy ~0.6 ev, with no decrease in critical shear stress effect. Both effects then anneal together near 320°C, with energy 2 ev. In aluminum, both effects completely anneal out together near −60°, with 0.55 ev energy. Data are correlated with diffusion activation energy for lattice defects. (auth)

RADIOACTIVITY

4623

THE α ACTIVITY OF ACTINIUM K(Fr^{223}). Jean-Pierre Adloff. Compt. rend. 240, 1421-3(1955) Mar. 28. (In French)

The α radioactivity of Fr^{223} was studied by exposing pure samples to Ilford C_2 plates for known periods of time. A half life of 22 ± 1 min was measured. The energy of the α radiation is 5.34 ± 0.08 Mev, with an α/β branching ratio of about 6×10^{-5}. (K.S.)

4624

METASTABLE STATE OF SHORT HALF LIFE IN Tc^{99}. Pierre Lehmann and Jacques Miller. Compt. rend. 240, 1525-7(1955) Apr. 4. (In French)

4625

THE BRANCHING RATIOS OF ^{86}Rb AND ^{42}K. E. W. Emery (Univ. of Manchester, England) and N. Veall (Guy's Hospital, London). Proc. Phys. Soc. (London) A68, 346-7 (1955) Apr.

The branching ratios were estimated by determining of the rate of γ energy, the measurements being made by comparison of the ionization current produced in a graphite chamber with that produced by a standard Ra source at the same distance. Aliquots of the solutions used for the γ measurements were assayed by 4π β counting and the disintegration rate determined. The results show that a γ ray is emitted in 8.5 ± 0.5% of the Rb^{86} disintegrations and in 10.8 ± 0.6% of the K^{42} disintegrations. (L.M.T.)

4626

THE DECAY OF 175 and 177 YTTERBIUM. H. de Waard (Nobel Inst. for Physics, Stockholm). Phil. Mag. (7) 46, 445-7(1955) Apr.

In the decay of 4.2 day Yb^{175} gamma rays of 113.0 ± 0.3 kev (γ_1), 281 ± 1 kev (γ_2) and 395.1 ± 0.3 kev (γ_3) were observed. Conversion data for these gamma rays are as follows: γ_1 : K/(L+M+N) = 2.5 ± 0.5, $\alpha_K = 2.25 \pm 0.5$; γ_2 : K/L > 4; γ_3 : K/L = 5.9 ± 0.7, L/(M+N) = 4.3 ± 1. The relative intensities (not taking into account the converted part) of these gamma rays are: $\gamma_1/\gamma_2/\gamma_3 = 0.5/1/2$. Furthermore, three beta components, leading to excited levels at 395.1 kev (β_2) and 113.0 kev (β_1) and to the ground state (β_0) were found, with energies: β_0: E_{max} = 463 ± 3 kev and β_2: E_{max} = 72 ± 3 kev and relative intensities: $\beta_0/\beta_1/\beta_2 = 87/3/10$. From beta-gamma and conversion electron-gamma coincidence measurements the decay scheme is unambiguously established. From the conversion and intensity data of the gamma rays follows that γ_1 is a mixture of M1 + E2 radiation with E2/M1 = 0.33 whilst γ_2 and γ_3 are mixtures of M2 + E1, with M2/E1 = 0.04 ± 0.02 for γ_2 and M2/E1 = 0.26 ± 0.07 for γ_3. Upper limits of 6×10^{-8} sec and 2×10^{-9} sec are given for the half lives of the 395 and 113 kev levels, respectively. In the decay of 1.8 hour Yb^{177} gamma rays of 119 ± 1 kev (γ_1') and 146 ± 1 kev (γ_2') were found, with K/(L + M) conversion ratios $3\ ^{+3}_{-1}$ (γ_1') and $3.5\ ^{+1.5}_{-0.5}$ (γ_2'). Further, the K conversion coefficient of γ_2', $\alpha_K = 0.63 \pm 0.08$ and the relative intensities of the gamma rays $\gamma_1'/\gamma_2' = 0.18 \pm 0.04$ were measured. The decay scheme is established. From the conversion and intensity data of the gamma rays follows that γ_1' is a mixture of M1 + E2 radiation and γ_2' a mixture of M2 + E1 radiation with M2/E1 ~ 0.1. A half life of 0.122 ± 0.005 μ sec was found for the 146 kev level in Yb^{177}. Three beta components with relative intensities $\beta_0'/\beta_1'/\beta_2' = 88/3/9$ are concluded to be present in the decay of Yb^{177}, leading to the ground state (E_{max} = 1.30 ± 0.05 Mev for β_0'), the 119 kev and the 146 kev level respectively. (auth)

4627

ANGULAR CORRELATION OF GAMMA RAYS IN ^{175}Lu. L. Akerlind, B. Hartmann, and T. Wiedling (Univ. of Stockholm). Phil. Mag. (7) 46, 448-9(1955) Apr.

4628

ON THE TOTAL DECAY ENERGY IN THE ORBITAL ELECTRON CAPTURE OF ^{181}W. A. Bisi, S. Terrani, and L. Zappa (Istituto di Fisica Sperimentale del Politecnico, Milan, Italy). Nuovo cimento (10) 1, 651-6 (1955) Apr. (In English)

An investigation of the radiations from W^{181} was made by means of a high-transmission β spectrometer, a proportional counter spectrometer, and a scintillation spectrometer. W^{181} was found to emit only Lx and Kx radiations, characteristic of Ta, arising from L and K capture. The decay energy was found to be: E_0 = 92 kev, and the transition was classified as once forbidden (ΔI = 0, 1; yes). The pairing effect in the region around A = 181 from the Suess-Jensen plot is briefly discussed. (auth)

4629

REVISION OF THE β-RAY SPECTRUM OF $^{214}_{83}Bi$(RaC). R. A. Ricci and G. Trivero (Istituto di Fisica Sperimentale del Politecnico, Turin, Italy). Nuovo cimento (10) 1, 717-21(1955) Apr. (In English)

4630

ON THE DECAY OF ^{134}Cs. G. Bertolini, M. Bettoni, and E. Lazzarini (Istituto di Fisica Sperimentale del Politecnico, Milan, Italy). Nuovo cimento (10) 1, 746-8(1955) Apr. (In English)

4631

RADIOACTIVE DECAY OF 65-HOUR Sb^{122}. Michael J. Glaubman (Princeton Univ., N. J.). Phys. Rev. 98, 645-52 (1955) May 1.

65-hour Sb^{122} was investigated by using Sb^{121} (97.7 %-99.4 %) that had been bombarded with thermal neutrons for

70 hours. Spectrometer measurements show three β groups with end-point energies: 1.987, 1.423, and 0.734 Mev; and log ft values: 8.6 [log ft(w^2-mc^2) = 10.0, $p^2 + q^2$ shape], 7.6 (allowed shape), and 7.7; and four γ rays with energies: 0.563, 0.0693, 1.152, and 1.256 Mev; and intensities: 73 %, 3.6 %, 0.75 % and 0.8 %. From γ-γ and β-γ coincidences the excited states of Te^{122} were found at 0.563 and 1.256 Mev. X-gamma coincidences and x-ray critical absorption showed 2.2 % and 0.8 % K-capture transitions to the ground state and to a 1.152-Mev level in Sn^{122}. The ft values for the transitions to Sn^{122} are 13 times smaller than the corresponding transitions to Te^{122}. Annihilation radiation was not observed setting an upper limit of 0.005 % for positrons. The directional correlation of the 0.693- and the 0.563-Mev γ rays indicated a 2−2−0 cascade, with the 2−2 transition 91 + 5 % quadrupole. The first excited state in Te^{122} was also shown to be 2+ from a measurement of the K conversion coefficient of the 0.563-Mev γ ray. It is concluded therefore that the ground state of Sb^{122} is 2− ($g_{7/2}$, $h_{11/2}$), the first two excited states of Te^{122} are 2+, and the first excited state of Sn^{122} may also be 2+. (auth)

4632

FAST E2 TRANSITIONS. A. W. Sunyar (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 98, 653-7(1955) May 1.

Lifetime measurements in the 10^{-8} sec range have been made for E2 or M1 + E2 transitions in the following nuclei: Sm^{152}, Gd^{154}, Hf^{180}, W^{182}, Os^{188}, Ir^{191}, Au^{197}, and Po^{210}. Upper limits for lifetimes have been established for E2 or M1 + E2 transitions in Ir^{191}, Pb^{204}, Pb^{206}, Pb^{207}, and U^{234}. E2 radiative transition probabilities are considered within the framework of the Bohr-Mottelson unified nuclear model. For neutron number N = 90 to 126, distortion parameters evaluated from E2 radiative lifetimes are about 5 to 6 times smaller than those evaluated from first excited state energies of even-even nuclei. (auth)

4633

ENERGY LEVELS OF Se^{76} APPEARING IN DISINTEGRATION OF As^{76}. J. D. Kurbatov, B. B. Murray, and M. Sakai (Ohio State Univ., Columbus). Phys. Rev. 98, 674-7(1955) May 1.

The radiations from As^{76} have been studied by means of a thick-lens magnetic spectrometer and a scintillation coincidence spectrometer. Five γ rays of energies 0.55, 0.64, 1.20, 1.40, and 2.05 Mev were observed by measurement of the photospectrum and they were fitted into a disintegration scheme with data obtained from γ-γ and β-γ scintillation coincidence measurements. The β spectrum was measured and the data treated by Fermi plot analysis; the end point, branching ratio, and log ft values found for each β component are as follows: 2.965, 2.41, 1.76, and 0.36 Mev; 50.5, 31.0, 16.0, and 2.5%; 8.4, 8.2, 7.9, and 5.6, respectively. (auth)

4634

HOLMIUM-167. T. H. Handley, W. S. Lyon, and E. L. Olson (Oak Ridge National Lab., Tenn.). Phys. Rev. 98, 688-9(1955) May 1.

Proton bombardment of Er_2O_3 yielded a holmium activity with a half-life of 3.0 hours. It was found to decay by emitting two beta particles with energies of 1.0 and 0.28 Mev and with gamma rays of 0.35- and 0.70-Mev energy. It was produced by $Er^{170}(p,\alpha)Ho^{167}$ and $Er^{167}(n,p)Ho^{167}$ reactions, and is assigned to Ho^{167}. (auth)

4635

DECAY OF Bi^{207}. N. H. Lazar and E. D. Klema (Oak Ridge National Lab., Tenn.). Phys. Rev. 98, 710-18(1955) May 1.

The gamma rays of 8.0-year Bi^{207} were studied with single-crystal and coincidence scintillation spectrometers. The measured relative intensities of the 0.570-, 1.07-, and 1.77-Mev transitions are 1, 0.84 ± 0.06, and 0.096 ± 0.007, respectively. Upper limits on the intensity of a 2.40-Mev and of a 1.47-Mev γ ray of 0.05 and 0.2%, respectively, of the 1.77-Mev γ ray have been obtained. Coincidence spectrometry with the lead K x rays indicates pure L-electron capture to the 2.34-Mev state and 2.8 ± 0.3% K-electron capture to the 0.570-Mev level. Other coincidence measurements agree quantitatively with the proposed decay scheme. The angular correlation of the 1.77−0.570-Mev cascade has been measured and is also in agreement with the proposed decay scheme. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

4636

CONTRIBUTION TO THE STUDY OF METAL HYDRIDES. THE LANTHANUM−HYDROGEN SYSTEM. Bertrand Dreyfus-Alain. Ann. phys. 10, 305-62(1955) Mar.-Apr. (In French)

SHIELDING

4637

PORTABLE RADIATION-SHIELDING MATERIALS. Nucleonics 13, No. 5, 84-6(1955) May.

Data are tabulated on composition, size, joint-type, weight, cost, and supplier of available portable shielding forms that can be used to build readily assembled, hand-stacked radiation shielding walls. (C.H.)

SPECTROSCOPY

4638 MLM-941

Mound Lab., Miamisburg, Ohio.

PRELIMINARY DESCRIPTION AND ANALYSIS OF THE SPECTRUM OF POLONIUM. G. W. Charles, D. J. Hunt, G. Pish, and D. L. Timma. Jan. 28, 1954. 27p. Contract AT-33-1-GEN-53.

Purified Po has been excited by high-frequency electrodeless discharges of 10, 30, and 400 Mc at temperatures ranging from 200 to 800°C, and in an enclosed spark source. One hundred thirty-nine lines have been found in the spectrum from the electrodeless discharge. Thirty-five of these and 13 additional lines have been observed in the spectrum of the spark discharge. Forty-eight lines have been classified as transitions involving 24 energy levels of Po I. Four levels of the fundamental configuration $6p^4$ have been identified. The observations have been compared with theoretical predictions for this configuration. Separations are well represented by theory with the parameter F_2 = 1.096 K and ξ = 12,379 K. The absolute value of the lowest level $6p^4\ {}^5P_2$ has been estimated from the first two members of the series $6p^3$ ($^4S^0$) ns. An estimate of 67,980 K is obtained. This corresponds to an ionization potential of 8.43 volts for the neutral polonium atom. (auth)

4639 OSR-TN-54-204

New York Univ., New York. Coll. of Engineering.

THE LINE WIDTH PARAMETER OF HDO AT LOW FREQUENCIES. REPORT NO. 289.2. Yardley Beers, Gabriel Herrmann, and Fred Sterzer. Aug. 12, 1954. 4p. Contract AF(600)-968.

The relative line width parameters of the $6_1 \rightarrow 6_2$ and $3_2 \rightarrow 3_3$ lines at respectively 2394.56 Mc/sec and 826.64 Mc/sec was determined as 1.0 ± 0.1, and the absolute value of the parameter of these lines was measured as 0.41 cm^{-1} at one atmosphere. The latter value is in good agreement with work by Strandberg in the conventional microwave region. Therefore no basis to support any hypothesis that the discrepancy between calculated and measured values of the absorption of radiation in the atmosphere by water is due to a variation in the line width parameter is found. (auth)

4640

FURTHER INVESTIGATIONS IN THE SPECTRO-ISOTOPIC ASSAY TECHNIQUE FOR LITHIUM. G. K. Werner, D. D. Smith, S. J. Ovenshine, O. B. Rudolph, and J. R. McNally, Jr. (Oak Ridge National Lab., Tenn.). J. Opt. Soc. Amer. 45, 202-5(1955) Mar.

Photoelectric methods have been applied to a spectro-isotopic technique for the analysis of isotopes of Li utilizing the isotope shift of 0.16 A. Sample time and precision have been considerably improved due to both the photoelectric method and improvements in hollow cathode and source design. At the 30% isotope abundance level the precision of analysis is ± 0.46% of the lower abundance isotope. (auth)

4641

NUCLEAR RESONANCE SPECTRA OF RUBIDIUM AND AMMONIUM FLUOROBORATES. D. Pendred and R. E. Richards (Physical Chemistry Lab., Oxford, England). Trans. Faraday Soc. 51, 468-75(1955) Apr.

Proton and fluorine magnetic resonance spectra are given for crystalline rubidium and ammonium fluoroborates at 20 and at 90° K. The measurements on the rubidium salt lead to a B–F distance in the BF_4^- ion of 1.43 ± 0.03 A. In the ammonium salt, the proton resonance line is considerably narrowed by molecular motion even at 20° K, and the results are best interpreted in terms of hindered motion of the ammonium ion about a C_2 axis which is associated with a very low potential barrier. (auth)

THEORETICAL PHYSICS

4642 AECU-3025

RAND Corp., Santa Monica, Calif.

EQUATIONS OF STATE ON THE THOMAS-FERMI STATISTICAL MODEL. Richard Latter. Apr. 1, 1954. 56p. [For Los Alamos Scientific Lab. Subcontract under W-7405-eng-36]. (R-277(RAND))

The usual theoretical calculations of equations of state and specific heats, particularly at high pressures, are dependent on the Thomas-Fermi statistical model of the atom. The mathematical description of this model involves complicated nonlinear differential equations, for which there have been an inadequate number of solutions available in the past. A number of solutions sufficiently extensive to determine the thermodynamic properties of all elements over an exceedingly wide range of temperatures and densities have been obtained with the aid of an IBM 701 Defense Calculator. The results are presented in graphical form. In addition, some of the analytic properties of the Thomas-Fermi equations have been investigated and certain approximate analytic solutions have been derived for limiting cases. (auth)

4643

A CONTRIBUTION TO THE THEORY OF NUCLEI WITH A DIFFUSE SURFACE. A. Janković (Univ. of Copenhagen, Denmark). Phil. Mag. (7) 46, 376-80(1955) Apr.

4644

APPLICATIONS OF CAUSALITY TO SCATTERING. Robert Karplus and Malvin A. Ruderman (Univ. of California, Berkeley). Phys. Rev. 98, 771-4(1955) May 1.

The optical dispersion relations are extended to the scattering of massive particles and are applied to the nuclear interaction of the pion-nucleon system. The sign of the forward scattering amplitude is unambiguously inferred from measured total cross sections and found to agree with that determined from Coulomb interference. (auth)

4645

CLASSICAL FIELD THEORY OF NUCLEAR FORCES. M. H. Johnson and E. Teller (Univ. of California, Livermore). Phys. Rev. 98, 783-7(1955) May 1.

An attempt to explain nuclear properties with the help of a classical nuclear potential whose quanta are π mesons leads to involved nonlinear interactions. We therefore used a potential whose quanta are neutral scalar mesons. Saturation properties, empirical binding energies, and observed nuclear densities are obtained if the potential depends on the velocity of the nucleons. This velocity dependence accounts for a number of additional nuclear properties. (auth)

4646

THE CUT-OFF METHOD IN MESON THEORY. Shigeo Goto (Gifu Univ., Japan). Progr. Theoret. Phys. (Japan) 12, 699-712(1954) Dec.

In the meson theory the cut-off method is adopted not only for convenience but also from the physical ground, considering the recent success of the application of the method to the analysis of the low-energy meson process. From this standpoint, the anomalous magnetic moments of the nucleons and the gamma decay of the neutral pions have been reexamined. The results have much improved those which have been obtained hitherto. The anomalous magnetic moment of the electron is also reexamined for the purpose of comparison of meson theory with quantum electrodynamics. (auth)

4647

NOTE ON THE ANGULAR DISTRIBUTION OF PHOTO-REACTION. Masato Morita (Kobayashi Inst. of Physical Research, Tokyo), Atsushi Sugie (Univ. of Tohyo), and Shiro Yoshida (Kyoto Univ., Japan). Progr. Theoret. Phys. (Japan) 12, 713-22(1954) Dec.

General formulas for the angular distribution of photo-reactions are obtained in a similar way to the case of particle reactions. Expressions thus obtained are more convenient in practical use than that obtained by Simon. (auth)

4648

BETA-RAY SPECTRA. III. Hisao Takebe (Univ. of Tokyo). Progr. Theoret. Phys. (Japan) 12, 747-57(1954) Dec.

In the general expression of the correction factor, there appear the integrals which contain the product of the nucleon wave functions. In this paper these integrals are expressed in terms of the radial integrals, by making use of the jj coupling model, and their non-relativistic approximation is discussed. (auth)

4649

KINEMATICAL INVESTIGATION OF THE S-MATRIX. Masaaki Kawaguchi (Kyoto Univ., Japan). Progr. Theoret. Phys. (Japan) 12, 758-66(1954) Dec.

A general method is proposed to investigate the kinematical properties of the S matrix in a covariant manner, independent of the method of approximation and the type of interaction. The S matrix is separated into a definite number of independent bases, i. e., the kinematical parts and their dynamical coefficients. The number and types of such kinematical bases are obtained for one-fermion problems and boson decay processes. As an application, some absolute selection rules for three-body decays are derived. For example, a spin O particle cannot decay into three photos, any two of which making an angle of 120° with each other. The same result holds for the decay of a spin 1 particle into three identical spin O particles. Some of the results are useful for analyzing the decay of τ meson. (auth)

4650

PION-NUCLEON SCATTERING IN THE TAMM-DANCOFF APPROXIMATION. Shin Chiba, Miwae Yamazaki, and Nobuyuki Fukuda (Tokyo Univ. of Education). Progr. Theoret. Phys. (Japan) 12, 767-88(1954) Dec.

The pion-nucleon scattering is treated in the Tamm-Dancoff approximation using the symmetrical ps-ps theory, with emphasis particularly on the renormalization procedure. The number of mesons and nucleon pairs is restricted up to two and one, respectively, in every intermediate state. In order to perform the renormalization consistently, it is required to adopt the five-box approximation of Bethe and Dyson. But even in this case, the meson self-energy term is not treated consistently and should be discarded. A method is proposed to remove the overlapping divergences and it is shown that the Salam's procedure can be carried out in a closed form. The scattering phase shifts are evaluated and compared with experiments. (auth)

4651

ON THE RELATION BETWEEN MESON-NUCLEON SCATTERING AND PHOTOMESON PRODUCTION. Masaaki Kawaguchi (Kyoto Univ., Japan) and Shigeo Minami (OSaka City Univ., Japan). Progr. Theoret. Phys. (Japan) 12, 789-801(1954) Dec.

Using the unitarity of the S matrix, Aizu and Watson have shown some relations between the photomeson production and the meson-nucleon scattering. Their theory is reformulated and generalized here in a summarized form, in order to make facile the analysis of experimental results. Experiments on the photomeson production near threshold energy lead us to suggest some limits on the magnitude of s-phase shifts of the meson-nucleon scattering and on the contribution of the nucleon current. (auth)

4652

MESON THEORETICAL POTENTIALS IN TRIPLET ODD STATE. Shoichiro Otsuki and Ryozo Tamagaki (Kyoto Univ., Japan). Progr. Theoret. Phys. (Japan) 12, 806-8 (1954) Dec.

This note presents a discussion of whether the second-order slight repulsive force in the triplet odd state can produce a negative P-wave phase shift, overcoming the contributions from the fourth-order terms and non-central terms which are effective in making the phase shift larger mathematically. (L.M.T.)

URANIUM AND URANIUM COMPOUNDS

4653 AECD-3657

Los Alamos Scientific Lab., N. Mex.

INDEPENDENT AND RELATIVE YIELDS OF I^{131}, I^{132}, I^{133}, I^{134}, AND I^{135} FORMED IN FISSION OF U^{235} BY 14-MEV AND THERMAL NEUTRONS. Arthur C. Wahl. [1953?]. Decl. Oct. 12, 1954. 40p. Contract [W-7405-eng-36].

The independent and relative yields of five nuclides in the neutron fission of U^{235} have been determined. The relationship of fission yield to chain position is discussed. (C.W.H.)

4654

ANGULAR DISTRIBUTION OF FISSION FRAGMENTS FROM 22-MEV PROTON-INDUCED FISSION OF U^{238}, U^{235}, U^{233}, Th^{232}, AND Th^{230}. B. L. Cohen, B. L. Ferrell-Bryan, D. J. Coombe, and M. K. Hullings (Oak Ridge National Lab., Tenn.). Phys. Rev. 98, 685-7(1955) May 1.

Angular distributions of several fission fragments from 22-Mev proton-induced fission of U^{238}, U^{235}, U^{233}, Th^{232}, and Th^{230} were measured. The data are fitted to $N(\theta) = \alpha + b \cos^2\theta$ where b ranges from 0.08α to 0.28α. The coefficients for possible "$\cos\theta$" terms (i.e., terms asymmetric about 90°) are no larger than 0.01α. In every case, asymmetric fission gives more anisotropic angular distributions than symmetric fission. The anisotropy in symmetric fission is about the same for all target elements; in asymmetric fission, the thorium isotopes have larger anisotropies than the uranium isotopes. Among the latter, the anisotropies are quite similar for U^{238} and U^{235}, but somewhat smaller for U^{233}. Explanations for various aspects of the phenomena are proposed. (auth)

4655

THE MAGNETIC GROUND STATE OF UF_3. M. C. M. O'Brien (Clarendon Lab., Oxford, England). Proc. Phys. Soc. (London) A68, 351-2(1955) Apr.

UF_3 grows with the Tysonite structure, each U atom having five fluorines as nearest neighbors and six as next nearest neighbors. The crystal field at the U was calculated by replacing these 11 fluorines and the six nearest U^{3+} ions by point charges and ignoring the rest of the crystal. g values of the ground state for the case of jj coupling are then determined. (L.M.T.)

4656

THE RELATIVE ABUNDANCES OF NEODYMIUM AND SAMARIUM ISOTOPES IN THE THERMAL NEUTRON FISSION OF U^{235} AND U^{233}. E. A. Melaika, M. J. Parker, J. A. Petruska, and R. H. Tomlinson (McMaster Univ., Hamilton, Ontario, Canada). Can. J. Chem. 33, 830-7(1955) May.

The relative fission yields of neodymium and samarium isotopes have been measured with a mass spectrometer for samples of natural uranium and U^{233} that had been irradiated with moderated neutrons. The cross sections for neutron capture by Sm^{149} and Sm^{151} have been determined to be 66,200 ± 2500 barns and 12,000 barns respectively, relative to the cross section of a B^{10} monitor. The half-lives of Pm^{147} and Sm^{151} have been evaluated to be 2.52 ± 0.08 yr. and ~93 yr., respectively, from samarium fission yield data for samples differing in age by seven years. (auth)

4657

TREATMENT OF GASEOUS URANIUM HEXAFLUORIDE BY MEANS OF AN INVERSE FORCE MOLECULAR MODEL. Juan A. McMillan. Publs. com. nacl. energia atomica (Buenos Aires), Ser. fis. 1, No. 3, 77-82(1954). (In Spanish)

Values are proposed for the parameters of force and potential energy, as deduced from experimental data of viscosity as a function of temperature. Equations for viscosity, thermal conductivity, and self-diffusion coefficients as a function of temperature, and the value of the thermal separation ratio are given. A good agreement with available experimental data has been obtained. The expression of the second virial coefficient is also established. (auth)